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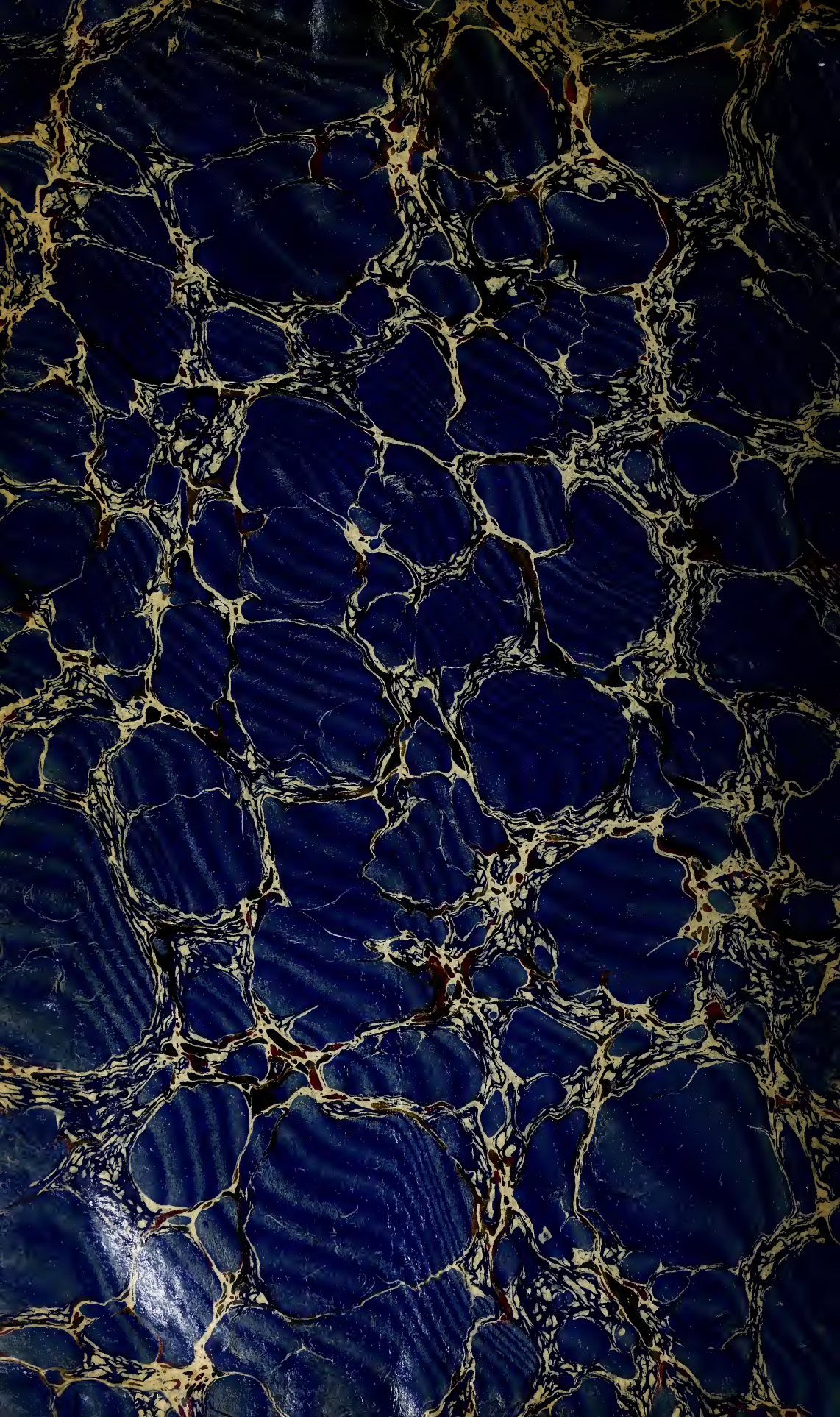
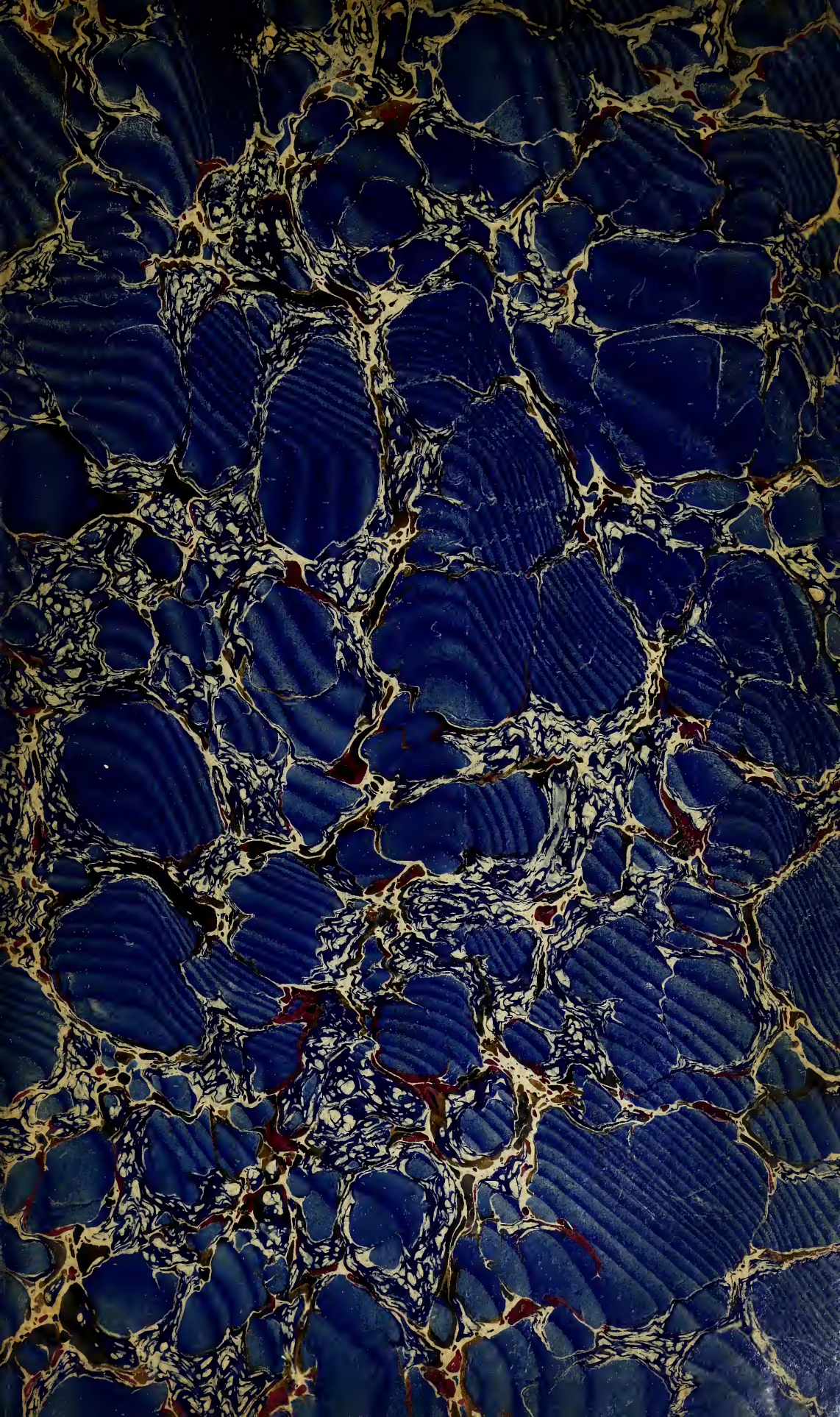
MONUMENT DEALER'S MANUAL





MONUMENT DEALER'S MANUAL

"The Monument Man's Encyclopedia"

A Hand Book of Ready Reference to Useful Information for the Monument Craft

Edited by O. H. SAMPLE

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CHICAGO

Press of Monumental News

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PART ONE

GENERAL REFERENCE SECTION

HOW TO USE THE AIR-BRUSH.

Familiarize yourself with the printed instructions sent out with the brush. Study them until you know each part and what part it plays in the working of the brush. There are three parts in the brush that have to do with the speed and quality of the spray. The air valve at the bottom, the needle and tip, and the cup and color passage. When the air does not come through the brush as it should, the rubber washer in the valve is probably swollen or worn out. Put in a new one. If the air keeps coming through after the lever has been released, there is lint or dirt or some foreign substance in the valve. Put in a new washer or clean out the obstruction.

Be very careful that the needle does not become bent. Never pull the needle back through the tip when it is bent. Take off the cap and straighten it first. A bent needle will cause a coarse, spattery spray. Dry or accumulated color on the tip will cause a coarse spray. Keep it clean by blowing plenty of water through the brush occasionally. If color has been allowed to dry in the cup and color passage, it is likely to cause a spray that is coarse and comes sputtery—will run a while and then miss. Clean out the cup and brush well with a saturated solution of sal soda. Blow plenty of water through it after using the soda solution. Strain all pigment or opaque colors before using through the brush to avoid trouble with the brush stopping up. Any color will accumulate lint and dust in time. It is a good plan to keep all colors strained once in a while. The secret of a good working brush all the time is to keep it clean all the time.

Never take the brush apart unless absolutely necessary. When it is necessary, be careful in putting it together again so that it is properly adjusted. Oil the working parts by using a little vaseline. Never put oil in the air valve at the bottom; it would ruin the rubber washer.

Work at the proper distance from the work to get the width and softness of spray you want. For the finer work, work closer to the card and do not use too big a spray. In laying a tone evenly on a given space, don't try to put it all on at once. Use a lighter spray and go over it until it is the color wanted. By going over the work this way it gives the color a chance to dry before more is blown on. Avoid flooding the color on the card in any kind of work. It destroys the beauty of air-brushing. Too high an air pressure, or too much color blown on a place will cause it to blow out in mossy looking lines or spider-webs that are hard to get rid of.

When using stencils, hold the brush about at right angles to the work. To get good, clean, sharp lines, it is necessary to hold the stencil close to the card while working. If you want a soft edge to the spray, hold the stencil away from the card. Cut your stencils correctly and there will be no trouble in using them. Better spend a little more time in laying out and cutting the stencil than to have all the work done be not quite right. A good quality of stencil paper is the best to use. In case you cannot get it, use any good strong paper or thin card. Such stencils should be coated with either shellac or oil paint before using them.

All shading of a design should be done while the stencil is on. First blow in a tone all around the design, then a darker tone of the same color or some contrasting or harmonizing color where the shadow would naturally fall if the design were really in relief. The modeling or rounding up of a design or letters is done after the stencil is removed. This may be in any way to suit the fancy. As a general rule it is safest to keep to the simpler ways of rounding up. When an elaborate style is used, it takes more time, and unless carefully done is seldom satisfactory.

One color blown on over another color has the same effect as mixing the colors

together, with the exception that the last color applied stands out the strongest. You can gray red with bright green; purple with yellow or russet green; blue with orange, or vice versa.

Keep an air brush away from sandpaper, pumice stone, sand, lint, or any kind of gritty stuff. You can't be too careful about using diamond dust or any of the flocks, smalts, or flitters, around where it might get into the air brush. Should any such substance get into the brush, fill the cup with water, place finger over the tip and blow the air back through the color passage and cup. Without letting the water back into the brush, by turning the air on, throw the water out and repeat until the obstruction is removed. Strain your color, keep the brush clean, and you'll have no trouble. L. O. BUTCHER.

The best known type of air-brush has a long, fine-pointed needle, fitting through a platinum sleeve so closely and accurately that when in its forward position it would be impossible, upon merely pressing down the lever, to allow even clean water to escape, but upon drawing back this lever (to which the needle is attached) with the downward pressure still maintained, a fine spray will be scattered which will increase in volume the farther the needle is drawn back. The full extent of the needle stroke does not exceed 1-16 of an inch, and so gradual is the tapering that even when drawn back to its maximum, only the thinnest mixture of color can pass evenly between the sleeve and the needle. It therefore follows that if we are to obtain the most satisfactory results, it will be necessary to build up our tint by repeated spraying with thin color until we have reached the brightness of strength required. Such work when finished will be practically grainless, and not liable to rub off, provided, of course, that the drawing surface is free from greasiness, or has been primed by either of the following methods:

1. Rubbed gently with a pad of cotton wool dipped in prepared pumice powder.

2. Sponged with weak ox gall, or, 3, a thin substratum of albumen or gelatine.

This priming is necessary only when working over highly glazed cards, or photographic surfaces which are liable to repel color.

Bristol Boards, Whatman, or other Drawing Papers will not require this treatment if quite clean.

It is of the utmost importance that the air-brush should be kept scrupulously clean, and never laid aside with a trace of color remaining in it, or trouble will assuredly follow. Pass two or three lots of clean water through it before commencing work, also on completion, before putting it in its case. Also during use it should occasionally have the nozzle cleaned with the point of a clean brush, and this very frequently if body color is being used, or this will accumulate around the point of the needle and cause trouble by frequently spitting.

Quite the majority of air-brush failures are traceable to using color much too strong, instead of building up with weaker color in the manner described in the foregoing remarks. Ticket writers and designers have a weakness in this direction when attempting to obtain their effects by one short spraying of color used much too thick. Such methods are foredoomed to failure, for not only has the spray a disagreeable sandy grain, but will also possess a strong tendency to rub off on the slightest provocation for the following reason:

An air-brush tint, even when sprayed on under the most favorable conditions, has not the same grip of the drawing surface as a patch of color washed on with a sable or camel's hair brush. The color is blown over the paper in the form of scattered dots, separated from each other at varying intervals according to the distance the point of the pen is held from the surface. The farther away the wider apart the dots, and the more liable to rub off, because much of the moisture is evaporated from the color before it reaches the paper, and its hold is somewhat precarious. Its sole chance of adhering firmly depends upon repeated applications until these isolated dots are joined by others, and so merged into a continuous tone.

When strong or imperfectly mixed color is used, this scattering action is still more pronounced, and with it there is increased tendency to rub off, because the air pressure, taxed to its utmost capacity in drawing it through so small an aperture, leaves these minute color particles insufficient moisture with which to attach themselves firmly. F. W. BROOKMAN.

HINTS ON AIR-COMPRESSOR INSTALLATIONS.

The following "Helpful Hints on Air-Compressor Installations" are from a recent booklet bearing that title issued by the Gardner Governor Co., of Quincy, Ill.:

"Get one big enough. You always find increased uses for air when you install a compressor. Air tools, as they wear, use more air and leaks will develop in the air line and hose, no matter how carefully watched. Inspect air line and hose every week at a time when the plant is shut down and everything is quiet, and you will be surprised at the number of leaks you find. Locate compressor in a light room free from dust and set it on a firm foundation. Some day you will have to work on it, so set it where you can get around on all sides and see what you are doing.

"Don't get the idea that any kind of an air tank will do for compressed air, and that a compressed air explosion isn't dangerous. Lives are lost every year from the use of old boiler shells or improvised tanks, the strength of which is unknown. A great many use for tanks the ordinary range boilers which were never designed for high pressure, especially those carried in some garages. In addition they always leak more or less at the joints; they are positively dangerous. The best tank is none too good. Life is too precious to risk for the sake of a few dollars saved in the cost of a tank. Drain your tank occasionally to get rid of the water precipitated from the compressed air.

"Most careful pipe fitting must be done to prevent leaks. When you desire to store air in a tank and draw from it as required and you find the pressure falls too rapidly, go over every joint with soap water and see if you can detect a leak. The air will cause the water to bubble. A surprisingly large quantity of air will leak through a most minute opening. It costs money to compress air, so don't let your money leak away.

"Stock safety valves are not tight enough to hold air. Get the kind that are tested by putting on pressure and holding under water, and if they bubble they are not good enough for air. Test the valve occasionally to see if it works.

"An air-compressor cylinder requires very little lubricating oil; in fact, it is hardly possible to feed it in slow enough for the best results. If a 12-inch cylinder gets two drops a minute it is a great plenty—smaller ones in proportion. Never use a cheap grade of oil. Any oil that will give good service in an automobile or gas engine is all right for an air compressor. All vertical splash type compressors carry over some oil, and unless great care is used in lubrication, so will the horizontal. On most work this small amount of oil is not objectionable; but where it is, a special separator should be used to eliminate it entirely. Consult with the compressor maker in such cases. Don't forget to give leather belt an occasional dressing with a good belt grease, or, if gear driven, lubricate the gears occasionally with graphite.

"Never carry a higher pressure than your compressor is guaranteed for. It is best in your regular work to find out just how much pressure is necessary and then maintain this pressure—the higher the pressure, the greater the power required. It is a waste of power, therefore, to carry an unnecessarily high pressure, and power costs money.

"The maximum speed given in a compressor manufacturer's table is as fast as any compressor should ever run.

"Compressing air raises the temperature—the higher the pressure the greater the heat. A great many users, not realizing this fact, and finding their machine running hot, attribute the trouble to lack of lubrication and use an excessive amount of oil. This only aggravates the heating trouble, as it causes the oil to carbonize on the valves and piston head.

"Use city water supply when possible. Where inconvenient to do so, a circulating pump makes a good substitute. Always use an open metal tank, as it permits the heat to escape from the water much better than a wood tank. Avoid using dirty cooling water—it clogs up the water jacket and reduces cooling efficiency. Don't forget to turn on cooling water when you start and shut it off when you stop. In freezing weather be sure to drain water jacket."

* * *

Considering that about two-thirds of the smaller dealers use the storage system of operating their air plants, it would be advisable for dealers that contemplate the installation of air power to profit by the experience of other dealers and use good judgment as to what capacity air plant their business most calls for.

The storage system we refer to is a system of many dealers to economize on their

electric bill and at the same time save considerable wear on the machinery. By letting the compressor run for three or four minutes enough air is pumped into the tank to operate one or two tools from fifteen to thirty minutes without power.

Past experience of the practical dealer has brought out this, and that is that the first compressor they invested in was not large enough to meet their present demands. At the time they bought the compressor they might have been using only two men, and it is perfectly natural that they thought a two-tool capacity air plant would meet their demands; but the experience these dealers went through has brought out the fact that no compressor under six-tool capacity is too large for a shop where two and three men are used.

In using an over capacity plant and using the storage system referred to, it will be found that the difference in the electric bill of a two and six-tool capacity plant amounts to a very little, or with the smaller plant which has to be run during the entire time of operating the tools. A good many dealers who use the storage system have found that they can still economize by connecting two tanks to the compressor instead of one. The connection of the two tanks can be made from one to another or they can both be connected separately to the main outlet of the compressor.

It is not necessary to have the tanks the same size, and many dealers take advantage of this by making use of their old, discarded tank as well as their new one.

When investing in an over-capacity plant we have enough power to pull through the best season, and if the business ever demands more men it is not necessary to buy larger machinery. G. A.

ARCHITECTURAL TERMS—A GLOSSARY.

Abacus—The uppermost member of the capital of a column, immediately under the architrave.

Acroter (also spelled Acroterium)—The ornamental finish to the apex of a gable, generally in Gothic architecture; also, a small pedestal for statues or other ornaments placed on the apex and at the basal angles of a pediment.

Annulets—A small flat fillet, encircling a column, used alone or with other moldings; several times repeated under the Doric capital.

Antefix—An ornament similar to the acroter, but smaller; ranged along the frieze; sometimes concealing the ends of the joint tiles of the roof, or pierced for the escape of water. Occurs on modern monumental buildings in the antique style.

Architrave—The lower member of an entablature, or the part which rests immediately on the column.

Arris—The sharp edge or salient angle formed by meeting of two surfaces; applied particularly to the edges in the moldings, or the raised edges, separating the flutings of a Doric column.

Cornice—a horizontal, molded or otherwise decorated projection which crowns the part to which it is affixed, as the cornice of an order, pedestal, door, window or house.

Corona—The projecting part of a classic cornice, the under side of which is cut with a channel to form a drip.

Echinus—The rounded molding forming the bell of the capital of the Grecian Doric order; the quarter-round molding of the Roman Doric style; a name sometimes given to the egg and dart, or egg and anchor molding.

Entablature—The superstructure which lies horizontally on the columns; it is composed of architrave, the part immediately above the columns, frieze, the central space; and cornice, the upper projecting molding.

Entasis—A slight convex swelling of the shaft of a column.

Fillet (or Taenia)—A narrow, flat member; especially a flat molding separating other moldings; also the space between two flutings in a shaft.

Flute—A channel of curved section; usually applied to one of a vertical series of channels.

Frieze—The middle part of an entablature of an order between the architrave and cornice; a flat member either uniform or broken by triglyphs, often enriched by ornament.

Guttae—A series of ornaments in the form of a frustum of a cone, attached to the lower part of the triglyphs, and also to the lower faces of the mutule in the Doric order.

Lintel—A horizontal member spanning

an opening, and carrying the superincumbent weight.

Metope—The space between two triglyphs of the Doric frieze, which the ancients often adorned with carving.

Mutule—A projecting block worked under the corona of a Doric cornice, corresponding to the modillion of the Corinthian and Composite orders.

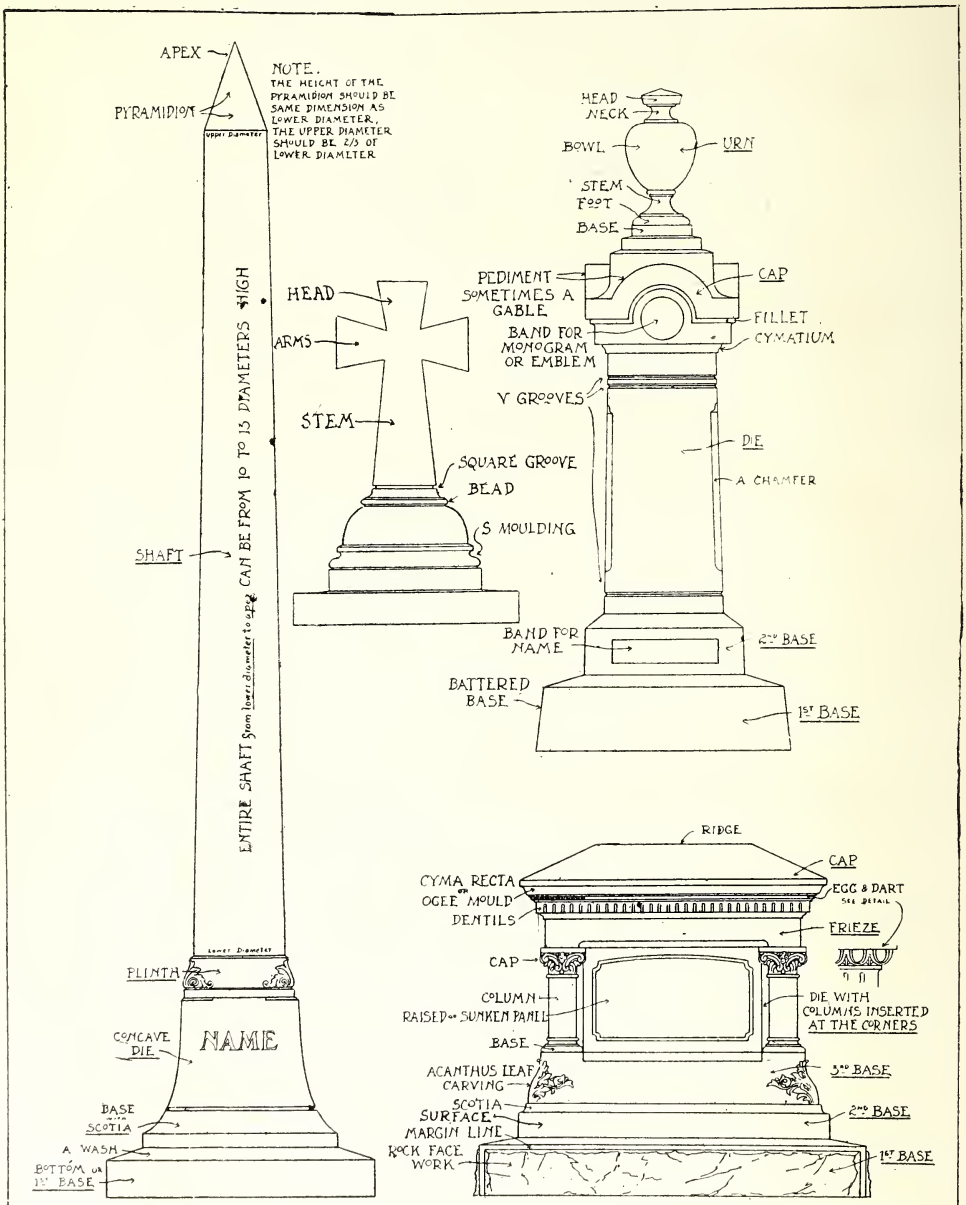
Parabolic Curve—A curve formed by the intersection of the surface of a cone with a plane parallel to one of its sides. Every point in it is equally distant from a fixed point called the focus and a fixed straight line called the directrix.

Pediment—The triangular space forming the gable of a roof; the triangular space over a portico, door, window, or similar situation.

Pilaster—An upright architectural member right-angled in plan, constructionally a pier, but architecturally corresponding to a column with capital, shaft, and base. The projection from the wall is generally one-third of its width or less.

Rabbet—A longitudinal channel, groove or recess, cut from the edge or face of one body, generally to receive another member; a groove cut for a panel.

Screen-wall—A dwarf wall or partition

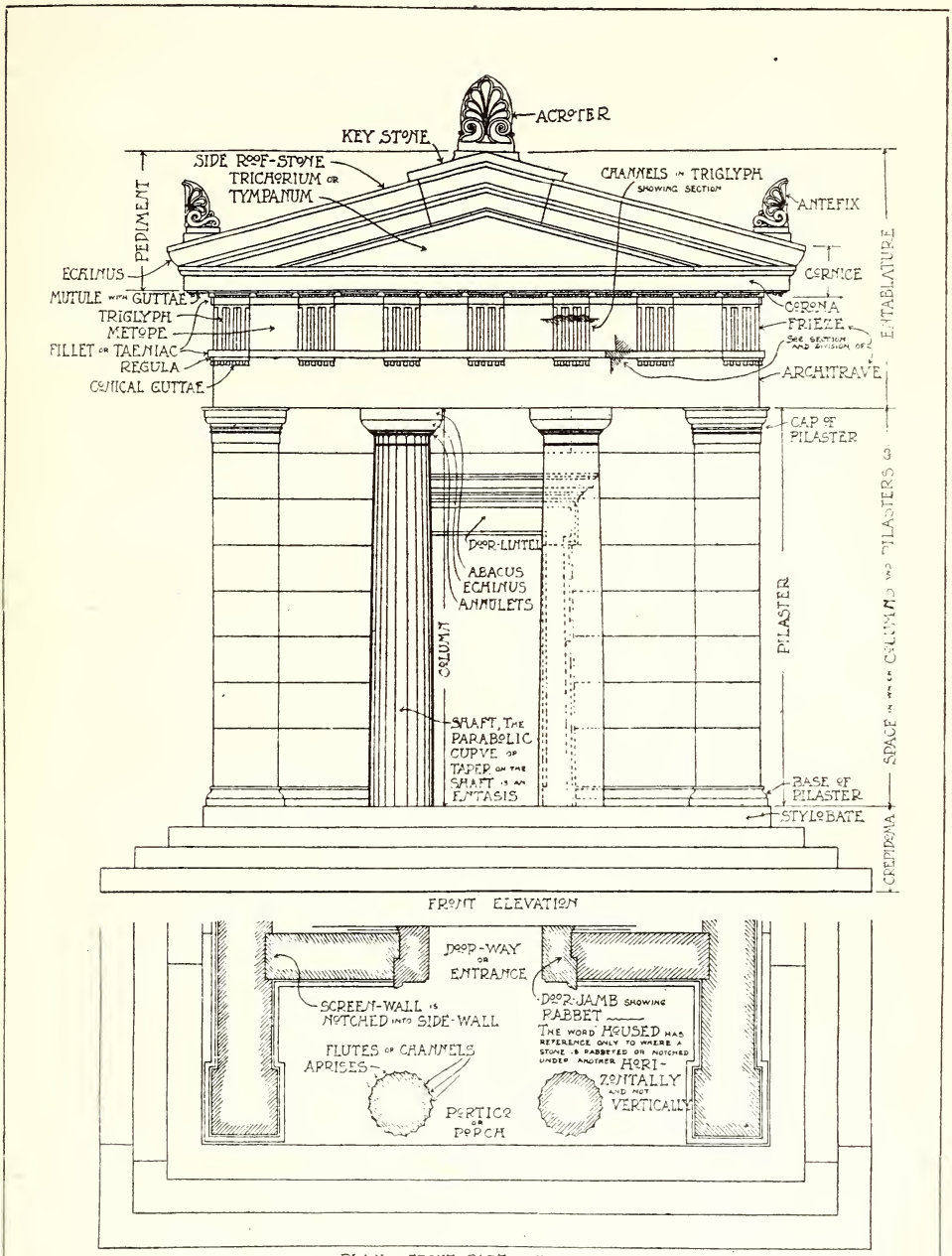


THE PARTS OF A MONUMENT PROPERLY NAMED.

carried up to a certain height for separation or protection, as in a church to separate the aisle from the choir.

Shaft—The body of a column, the cylindrical pillar between capital and base.

top by two parallel, perpendicular gutters, called glyphs, into three parts or spaces called femora. A half channel is cut upon each of the perpendicular edges of the tablet.



ILLUSTRATING ARCHITECTURAL TERMS.

(See Opposite Page.)

Stylobate—A continuous flat band, coping or pavement, upon which the bases of a row of columns are supported.

Triglyph—A repeating ornament in a Doric frieze, consisting of a projecting rectangular tablet, divided nearly to the

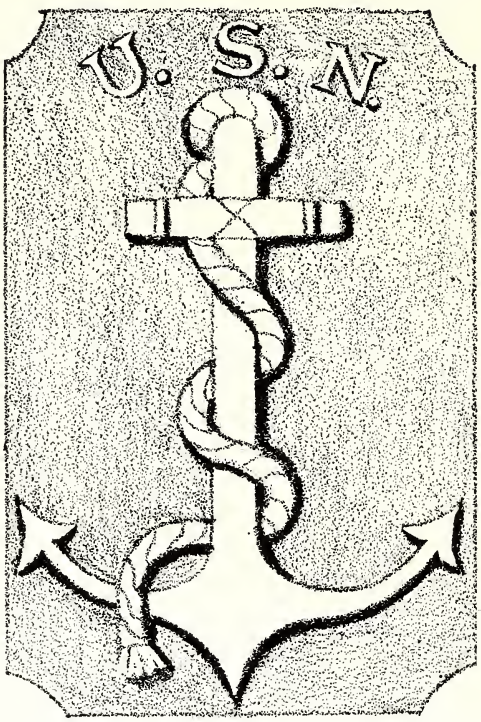
Tympanum—The recessed face of a pediment, within the frame made by the upper and lower cornices; or the space within an arch, and above a lintel or subordinate arch spanning the opening below the arch.

ARMY AND NAVY INSIGNIA FOR MONUMENTAL DECORATION.

In the military memorials, both public and private, that will be erected to our soldiers of the present war, the emblems and insignia of rank will take indispensable place as decorations.

Many of these are so admirably suited to monumental decoration that their use, especially on private cemetery memorials to soldiers, is really essential to the achieving of something of symbolic significance.

Realizing the importance of these emblems to monumental decoration we here present to the trade for the first time correct drawings of practically all of the army emblems and insignia of rank. These were especially drawn for stone carving and will be found readily adapted to monumental use.



GENERAL EMBLEM FOR THE NAVY.

While the drawings are self-explanatory, some additional details regarding some of them may be of value. The insignia of rank worn on the shoulder loops by commissioned officers, bear gold or silver emblems, the ornament on the narrow end in every case being the regulation bronze army button bearing the coat of arms of the United States. For all grades of generals the stars are of silver. The emblems for colonel and lieutenant colonel are of silver, and the oak leaf of the major is gold. The bars on captain's and first lieutenant's shoulder loops are silver and the single bar of the second lieutenant is gold.

The collar insignia illustrated are all of bronze, except that gold letters are superimposed over the bronze insignia, indicating the various corps of the medical department.

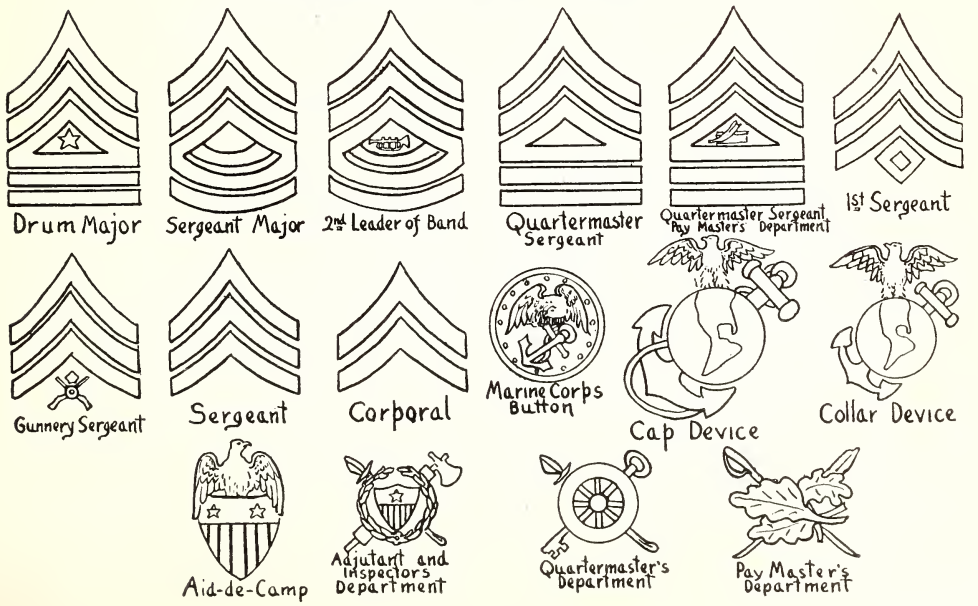
The hat cord is the most readily distinguishable indication of the branch of service, but as they differ only in color, no drawings of these can be given; the colors are as follows: General officers, all gold; field officers, gold and black; line officers, gold and black; reserve officers' training camp, red, white and blue; infantry, light blue; artillery scarlet; service school detachment, green; cavalry, yellow; engineer, scarlet and white; quartermaster corps, buff; ordnance, black and scarlet; signal corps, orange and white; medical department, maroon and white; staff departments, black; field clerk, silver and black; officers of voluntary training corps and reserve militia, gold and black; men of the volunteer training corps and reserve militia, blue and white; Y. M. C. A., steel blue.

The badge on the officer's garrison or service cap is a bronze representation of

CHEVRONS AND SPECIALTY MARKS COAST ARTILLERY

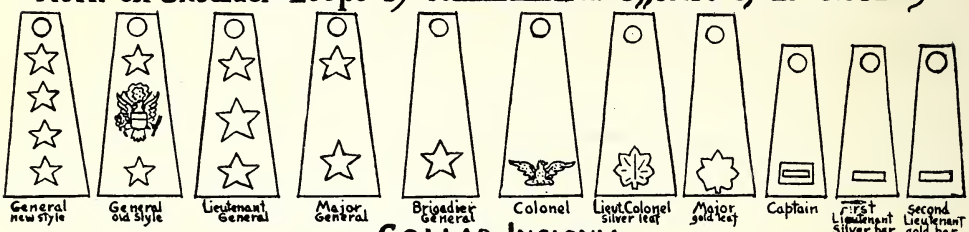
COLLAR INSIGNIA WORN BY ENLISTED MEN

U. S. MARINE CORPS
CHEVRONS AND DEVICES



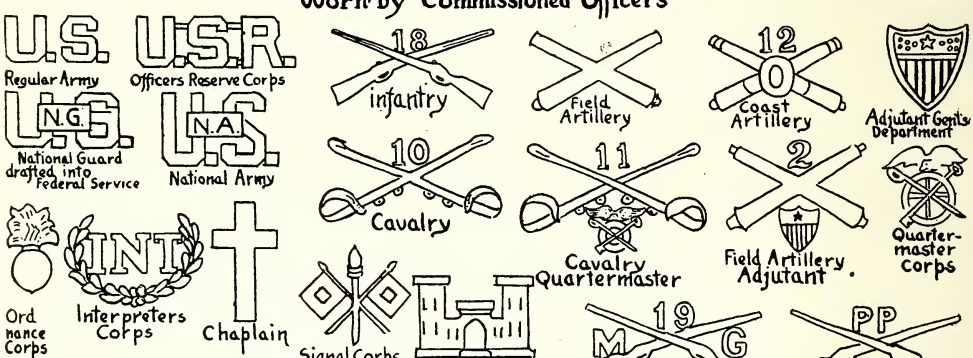
INSIGNIA OF RANK

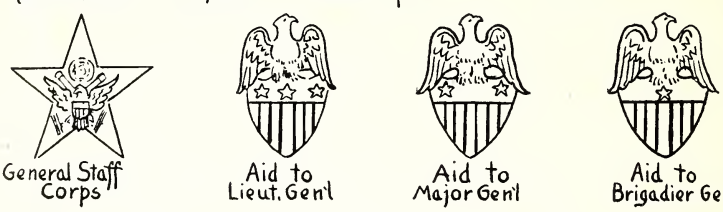
Worn on Shoulder Loops by Commissioned Officers of the U.S. Army



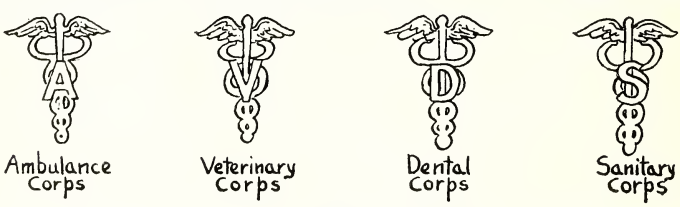
COLLAR INSIGNIA

Worn by Commissioned Officers

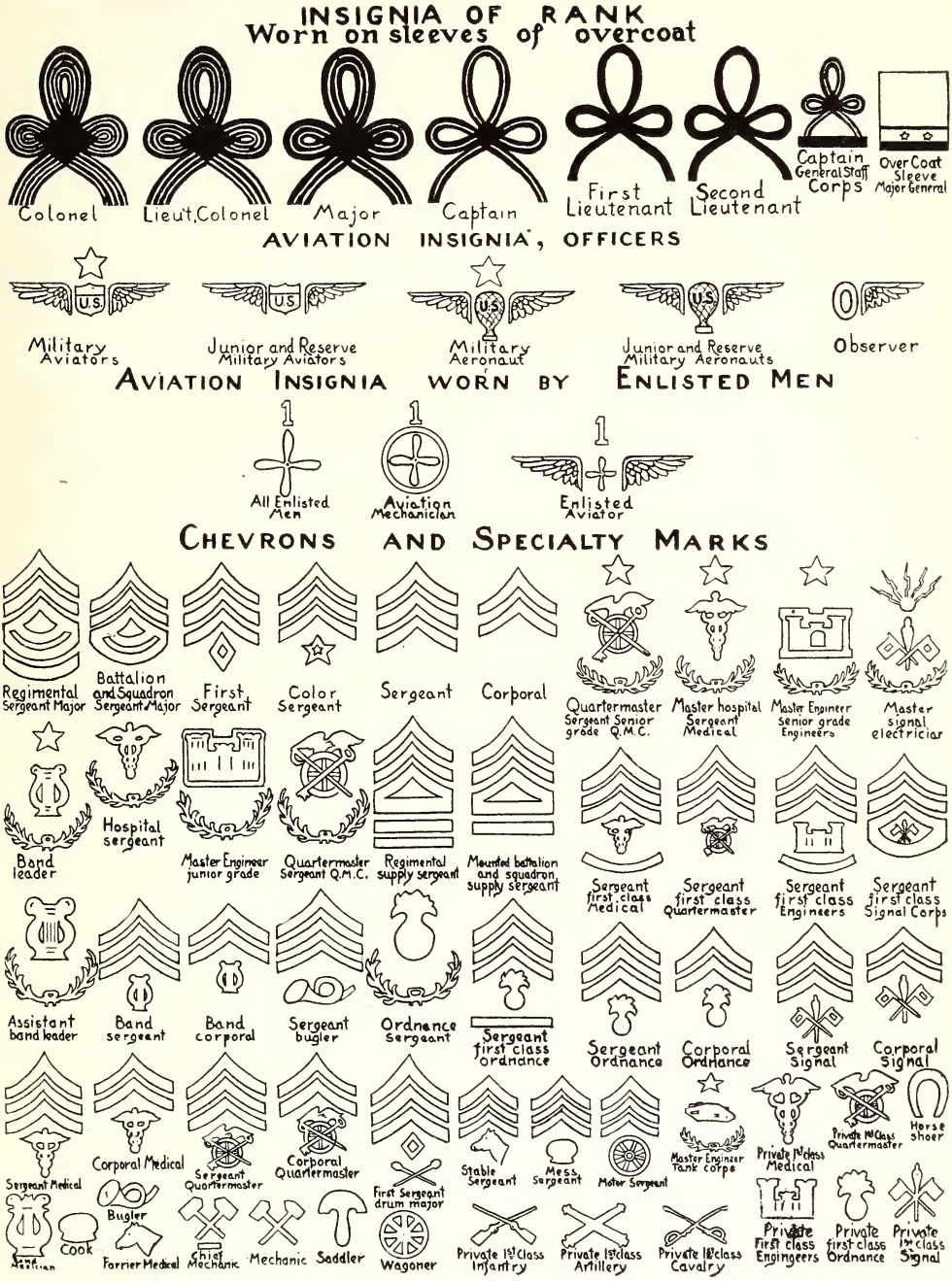




COLLAR INSIGNIA OF THE SUBDIVISIONS OF THE MEDICAL DEPARTMENT

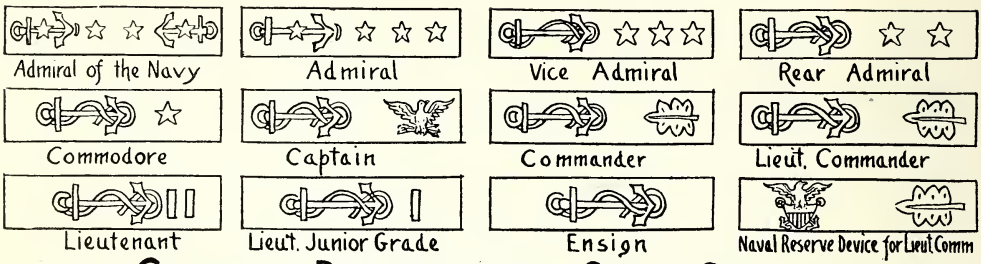


INSIGNIA OF THE VARIOUS RANKS AND BRANCHES OF THE ARMY.

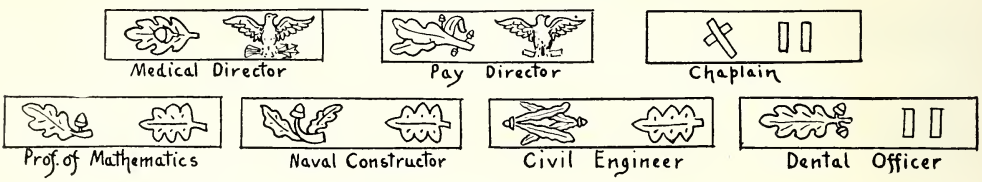


INSIGNIA OF THE RANK AND OF THE VARIOUS BRANCHES OF THE ARMY.

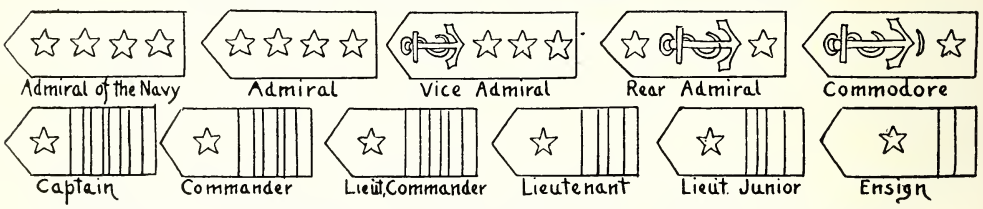
COLLAR DEVICES FOR LINE OFFICERS



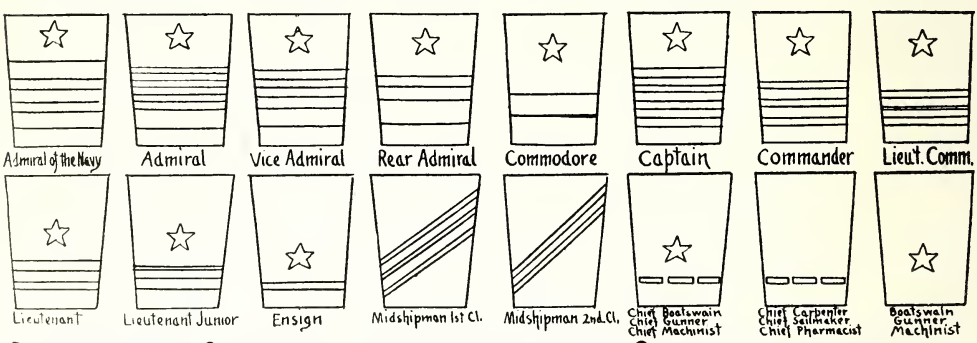
COLLAR DEVICES FOR STAFF OFFICERS



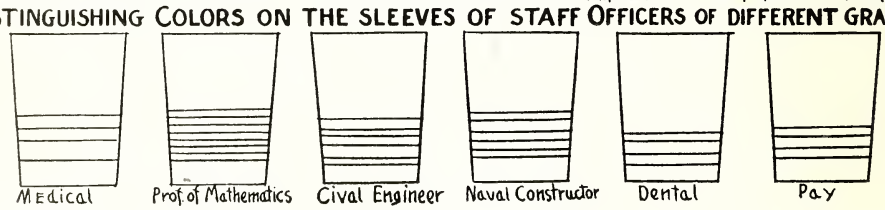
SHOULDER MARKS FOR LINE OFFICERS



INSIGNIA OF RANK OF NAVAL OFFICERS WORN ON SLEEVE

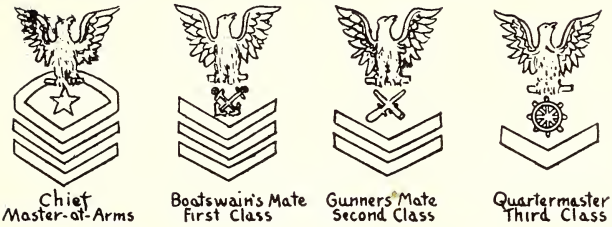


DISTINGUISHING COLORS ON THE SLEEVES OF STAFF OFFICERS OF DIFFERENT GRADES

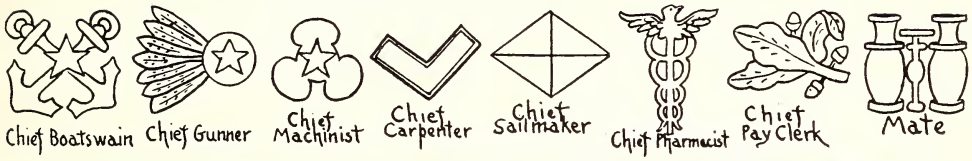


INSIGNIA OF RANK AND BRANCHES OF SERVICE IN UNITED STATES NAVY

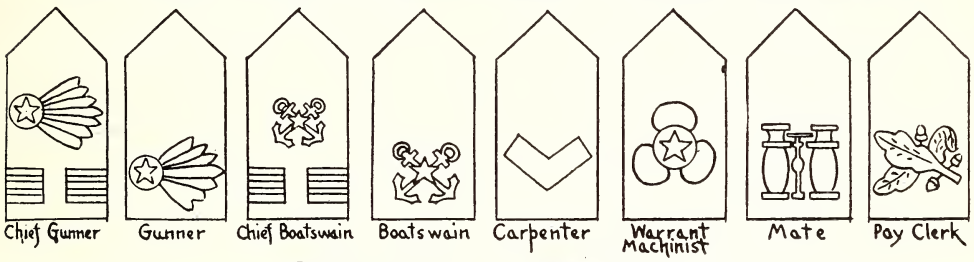
BLUE RATING BADGES



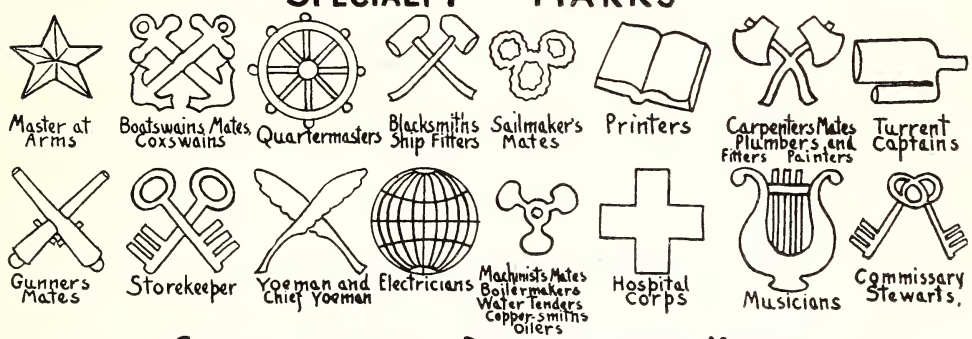
COLLAR DEVICES FOR WARRANT OFFICERS



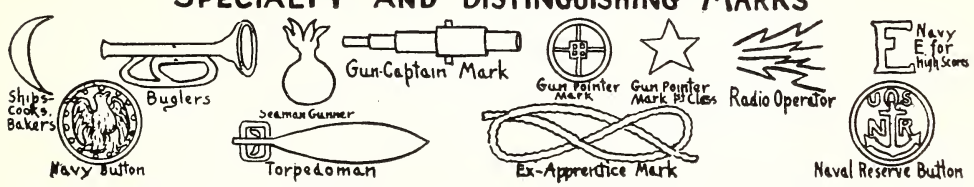
SHOULDER MARKS FOR WARRANT OFFICERS AND MATES



SPECIALTY MARKS



SPECIALTY AND DISTINGUISHING MARKS



INSIGNIA OF RANK AND OF BRANCHES OF SERVICE IN UNITED STATES NAVY.

the coat of arms of the United States. Enlisted men are permitted to wear on the cap a disk one and one-half inches in diameter with a raised rim encircling the coat of arms.

The majority of the navy insignia of rank are of either gold or silver on blue. The shoulder marks for line officers consist of gold stripes and stars on a blue badge of pointed shape. Officers above and including that of commodore have the entire epaulette of gold with stars and anchors of silver. The sleeve insignia of officers are practically all of gold.

Staff officers wear the same stripes as the line officers but not the stars.

The marks for the petty officers, warrant officers and the specialty marks reproduced here are practically all self-explanatory.

There is no distinguishing emblem for the common seaman, but the general emblem for the navy, illustrated here, would be appropriate for a man of any branch or rank in the navy.

WEATHERING AND CARE OF BRONZE WORK.

We have a bronze tablet we placed on a cement vault and it became covered with verdigris once and we sent it back to the manufacturers and they cleaned it and shellacked it and returned it. It has been up about two years the last time and is covered again. Is there anything we can do to remove this verdigris? Is this peculiar to all standard bronze?—J. B. M.

It is to be expected that a cast bronze tablet would become covered with verdigris if put up in a very damp place. Any alloy of copper, whether it be brass, which consists of about 66 per cent copper and the remainder tin and zinc, or standard statuary bronze, consisting of 90 per cent copper and 10 per cent tin and zinc, will form a surface color, called by the French "patine," according to the nature of the chemical applied to the alloy. Thus sulphur fumes and an application of sulphide of potassium will quickly cause a reaction on the surface of the bronze, coloring it a dark brown. Statuary and architectural bronze work exposed to the atmosphere of our cities in which there is much coal smoke quickly turns very dark.

The green coating on bronze is produced by the action of vinegar or sal ammoniac. If the tablet in question has become covered with verdigris it would show that the moisture in the cement vault is impregnated with salts. To many people this surface color, whether it be the brown of statuary bronze, or the green color of verdigris, is a distinct advantage from an artistic point of view. For example, the Statue of Liberty in New York harbor has under the influence of salt air acquired a beautiful green color. Some practical people, thinking that a corrosion, a result of age, considered it a species of dirt and therefore have invoked the War Department to scrub down "Miss Liberty" to the original bronze color, all of which was most strenuously opposed by those who admire the softening influence of time and atmosphere on monuments, buildings, statuary, etc.

If your correspondent wishes to remove the verdigris from the bronze tablet, simply let him scrub it down with white sea sand and water in which there has been dissolved a small quantity of sulphuric acid. However, perhaps we had better give you a full recipe for cleaning bronze and restoring the oxidized statuary finish. This recipe is as follows:

First, mix potash of lye with hot water. Apply this vigorously with a stiff brush, also using white sea sand. Repeat this rubbing with the potash and sea sand until all dirt and grease are removed; then wash with clear water and scrub with a "pickle" composed of sulphuric acid (oil of vitriol) and water, one pound of sulphuric acid to a gallon of water. Be sure to pour the acid into the water, and not the water into the acid. This combination will generate considerable heat. Wait until it cools before using. Scrub the tablet with sea sand and water, then scrub with sulphuric acid pickle until all discoloration, green spots, etc., are removed and the natural bronze appears. Wash off the pickle entirely with clean water, then use sea sand freely. The bronze should then be bright clean, the color of a new cent. Then mix one-half pound of potassium sulphide with one gallon of water. This forms an oxidizing fluid which will stain the bronze to a dark color. If it does not stain quick enough or dark enough, use more of the potassium sulphide. After having made the first application of oxidizing fluid to the bronze a light stain is obtained. This must be well sanded with sea sand and washed with clean water. Repeat the applications of the oxidizing solution and the sanding down of same until the color is brought to a uniform dark tone. It is preferable that the water which is used to wash down the bronze after the application of oxidizing fluid be hot, but cold water will do. Immediately after the oxidizing fluid is applied and a satisfactory bronze color obtained and has been washed with water, use tissue paper to dry off the water. When thoroughly dry go over the bronze with a soft cloth dampened with oil (any kind of oil will do). These solutions are poison and should be destroyed when work is completed. Do not get lye or the sulphuric pickle on hands or clothes.

To prevent a recurrence of the staining of the tablet by verdigris, referred to by your correspondent, some little attention should be paid to the bronze from time to time. There is no use of shellacking the bronze or giving it a coat of varnish. It must be rubbed from time to time with an oil-dampened cloth. If this is not done the bronze will stain and the above treatment will be necessary to bring it back to

a good condition. The statuary in our cities should be scrubbed down with lye and all the surface discoloration, soot, grime and dust removed and rubbed with a soft cloth dampened with oil, but, of course, under no circumstances should the sand be used on the statuary, for this would bring it down to the raw color of the metal. Incidentally, when bronze is set up it seems that it is expected to retain a beautiful color ever after, and, of course, when the sculptor is all through he cannot afford to keep bronzes in condition, and we cannot count on him.

The bronze foundrymen have completed their contract in casting the work. No attention can be expected from city authorities, and the owners of fine bronze work never think of making an expenditure for proper cleaning and care which should be given the work from time to time.

One of the beauties of bronze is the varied coloring of the surface acquired by exposure to the weather or to chemicals. The natural color of the metal is a reddish golden hue, the color of a new bronze cent. Under the action of the elements this golden color soon darkens by oxidization. If the bronze is exposed to sulphur fumes or to any of the chemical forms of sulphur, it will take on a brownish tint, sometimes so dark as to appear almost black. Thus, in our cities, sulphur in the coal smoke soon turns the statuary practically black. The green color on bronze, sometimes termed "Verd-antique," is brought out by the action of salts, vinegar and sal ammoniac. Bronzes near the seashore, exposed to the salt air, usually are a beautiful green color. An example of this is the Statue of Liberty in New York harbor. These surface colors of bronze are termed by the French "patinas." It matters not how old the bronze, the color is, like "beauty," only "skin deep." Scratch it ever so lightly and the glowing golden metal shows beneath. Therefore in cleaning old bronzes on monumental work or elsewhere, one should be careful not to abrade or scratch the surface of the bronze. If discolored with an accumulation of dirt, soot and the grime of years, this may be removed with plain soap and water. When dry, the application of a soft cloth dampened with oil will restore the bronze to good condition, and the further application of an oil-dampened cloth at long intervals will bring the bronze finally to a condition where the mellow tones of the surface coloring will delight the connoisseur and lover of bronze work.

Wm. Donald Mitchell,
Jno. Williams Bronze Foundry.

VERDIGRIS ON BRONZE

Our experience has demonstrated that bronze work set on cement, limestone or brick work which is set in lime-mortar or cement has a tendency to take on verdigris. We assume that this effect is caused by rain water running down over the masonry wall and continuing over the bronze surface, carrying with it some chemical quality from the cement, which, acting on the copper, produces verdigris. We have never investigated this question from a chemical standpoint, but simply know it to be a fact. The only remedy we can suggest for avoiding this would be to have the bronze cleaned frequently. We do not believe any shellac or lacquer would permanently protect it, although an exterior or spar varnish applied to the bronze after cleaning would preserve the finish for a longer period, but would give the metal a shiny appearance that is not considered desirable. By many architects and artists this verdigris coloring is regarded as one of the beautiful and interesting effects which bronze takes on with age. Personally, we favor the antique effect of verdigris, which usually blends beautifully and naturally with cement colors.

The Gorham Co.

* * *

From our experience of twenty-five years in the casting and finishing of bronze tablets and monumental work in general we find that the metal called bronze, when made up of the best quality of alloys mixed in correct proportions and when properly treated and erected under normal climatic condition, will never show verdigris discoloration. Bronze, like other metals, will darken when exposed to the chemical action of the air, but this natural oxidation or patina, when obtained in a normal way, gives a far more artistic finish to the object, be it tablet, door or statue. Our experience has shown that the occurrence of verdigris stains on bronze tablets is usually due to one of two main causes. The first is exposure to the

salt-laden air which comes from the sea and when the tablet is erected in fairly close proximity to the seashore. It is well known that saline solutions will create verdigris on bronze or copper. In fact, salt is one of the mediums employed, in combination with other ingredients, to obtain the genuine green patina or verdigris effect, so much admired in small bronzes. When verdigris stains are due to above cause there is practically no remedy. Lacquer or wax applied to the face of the tablet will retard the process of oxidation for a short time, but these two mediums will in their turn be ultimately destroyed, and generally in so uneven a manner that certain parts of the metal will oxidize more quickly than others, with very unsatisfactory and inartistic results.

The second cause is improper treatment of the bronze, even when of the highest grade. A bronze casting, after coming out of the mold and before going into the finisher's hands, must be dipped, an artisan term which means that it must be passed through a bath made up of certain proportions of sulphuric and other acids, in order to take away the scale put on the metal in the process of casting. It sometimes occurs that bronze castings, even those made with the greatest care, are very slightly porous in spots. In the dipping process the acids naturally enter these pores, and unless thoroughly washed out with hot water, they remain in the metal, oxidizing the same, and are subsequently brought out after exposure to the weather. For this, the remedy is obvious and lies entirely in the manufacturer's hands.

Still another cause for the unsightly discoloration so often seen on bronze tablets lies in the very poor quality of the materials used in making up the bronze. There are founders, unfortunately, who are not at all particular as to the composition of their bronze. Everything short of rusty nails is thrown into the crucible, and the result is a mixture in no way connected with metallurgy and from which no satisfactory results can be expected. The most distressing part of it is that in many cases this is done, not so much through ignorance as through a desire for larger gains. This emphasizes the necessity of purchasing bronze work from reliable houses and insisting upon the best quality of material only.

In the case stated by your correspondent, if the trouble is not due to one of the causes mentioned above, there must be something chronically wrong with the tablet and it seems to us as though the only remedy would lie in casting an entirely new one. Verdigris is more troublesome than almost any other kind of stain and harder to eradicate, as it eats into the metal. Stains of this character should be rubbed off with a mixture of powdered pumice stone and water, applied with a stiff brush. Pumice stone possesses cutting qualities which will destroy almost any kind of stain, and although this process will leave bright spots where the stains first appeared, they will gradually darken after they have been exposed to the action of the air for a sufficient lapse of time.

It is possible that the verdigris stains complained of by your correspondent might be due to the nature of the cement to which the tablet is affixed. If the cement contains lime or other substances of like nature, it would be apt, through moisture or rain, running from the cement on the tablet, to cause the trouble referred to. We offer this as a suggestion which it might be well for your correspondent to follow up.

PAUL E. CABARET & CO.

* * *

In regard to verdigris on bronze, bronze left to the elements will take on more or less of this character, depending a great deal on atmospheric conditions. Peculiarities of trees, climate or water in the immediate vicinity often influence bronze to produce effects in some instances very singular. Apart from these considerations, and apart from the rules for compounding bronze, and so on, there are many other influences that give character to bronze, as may be witnessed in the widely different appearance of various works in bronze when exposed to outdoor conditions.

AMERICAN ART BRONZE FOUNDRY.

REMOVING STAINS FROM BRONZE DOORS.

A recipe for removing stains caused by dogs on bronze vault doors is given as follows by Paul E. Cabaret & Co., New York: "If the stains are due to the cause mentioned, there is only one way to remove them, and that is to rub them over with powdered pumice stone and water. This will of course leave bright spots after the work is done, but these spots will eventually turn dark again to match the rest of the doors. If, however, it is desired to darken these spots after the stains have been removed, a mixture of sulphur when dissolved in water, not too strong, and applied with a rag or a brush, will cause the spots to darken. We would suggest, however, that the spots be left to darken naturally through the chemical action of the air.

If acid has eaten into the bronze, the only way to remove the stains would be to file out the spots. If, however, they are only surface stains, they can be removed with a mixture of rotten stone and oil rubbed on with a rag, care being taken to remove the oil when the spots have been eradicated. If the spots are hard to remove, the best way would be to rub them first with fine powdered pumice stone and water and finish off with the rotten stone and oil mixture.

CLEANERS AND STAIN REMOVERS

CLEANING AND PRESERVING OLD MONUMENTS.

The cleaning and preservation of old monuments is a matter of much importance in cemeteries of any age and is sure to present itself to every cemetery in a more or less acute form sooner or later. Monument dealers have in a number of instances made a business of resetting and repairing stones in old cemeteries and might profitably give attention to experimenting with the cleaning of old monumental work and the rehabilitating of ancient cemeteries generally.

Frequently when marble is exposed, as in a cemetery, where it is more or less sheltered by trees, it is disfigured by lichens and other vegetable growth.

In many instances this growth has died and become brown or black in color. Prof. F. P. Dunnington, of the department of chemistry of the University of Virginia, informs us that all such discolorations may be readily removed by soda lye of moderate strength, about 5 per cent. That which is rotted is disolved and the remainder is soon distintegrated.

Prof. Dunnington has made careful experiments with marble cleaning solutions and had occasion to give thorough tests to his preparations in cleaning the marble stones in the little cemetery at Charlottesville, Va., where the university is located.

His method of preparing and using the solution mentioned was as follows: A box of concentrated lye, containing about twelve ounces of caustic soda, is dissolved in a two-gallon bucket of water. Spread this over the stone with a small, cheap scrubbing brush, made with vegetable fiber, preferably provided with a handle so as to avoid getting the lye upon the hands, the clothes or the shoes. After ten minutes or more pour water over the stone to wash off most of the lye and then rub it a little with the brush, using some sand, if necessary, and the stain will be removed.

Of course, this liquid has no effect upon the stone itself and is easily washed away. As for the wash falling upon the ground, it will improve rather than harm any grass or other plants. Should the lye remain upon the skin, it may occasion an ugly sore. If splashed upon the clothing, the prompt application of a solution of sal ammoniac will prevent corrosion of the goods. In his work this treatment cost about 25 cents for each stone.

Bellefontaine Cemetery, of St. Louis, has also given much time and expenditure to conducting experiments for cleaning monuments, and has recently issued a circular which they have sent to monument makers and cemeteries.

In addition to the method of Prof. Dunnington, Prof. J. W. Mallett, of the University of Virginia, describes the following experiments made by him at the request of this cemetery:

I have finished a series of experiments with the samples of stones for monuments sent me by you at the beginning of last month. It is, of course, impossible to compress into a few weeks a full reproduction of the conditions affecting stone through a long succession of years. But I think you may with best prospects of success treat the materials you have to deal with by brushing them over carefully with a strong solution of silicate of soda, also commercially known as "soluble glass" or "water glass." This can best be bought in an already dissolved condition, which should be clear and colorless, or almost entirely free from color. It should be applied of a consistency like that of rather thin ordinary oil paint. If originally as viscid as thick molasses, a little water may be added to bring it down to the proper consistency. To be efficient, it is of the greatest importance that the application shall be made when the stone is as dry as possible, preferably after a protracted period of warm weather. In the case of all limestones, Nos. 1 to 6, inclusive, of your samples, this is the only solution to be used; but in the case of No. 7, sandstone from Warrensburg, Mo., after the silicate of soda has soaked into the surface, and dried, it should be followed by a solution (of the same thin paint consistency) of chloride of calcium. The chloride can be bought in solid form, should be selected free from any distinct color, and should be dissolved in a small quantity of water to give the right consistency. Both the materials mentioned are cheap, and easily procurable from any dealer in chemicals. No marked effect on the appearance of the stone is to be feared, but when both chemicals are used there is

liable to be a slight frost-like efflorescence on the surface, which is gradually washed away by subsequent rains. The Warrensburg stone is so deficient in cohesive strength that its use should be avoided, I think, for the future.

As an alternative for the above treatment with silicate of soda, which I am inclined to believe you will find most efficacious, you might try brushing over the stone with a nearly saturated solution of hard paraffine in gasoline. With the paraffine and gasoline I have (the latter boiling at about 45 to 50° C.), and at the temperature of the last two or three weeks (about 20° C. indoors), such a solution requires about 12 or 13 ounces of paraffine to the gallon of gasoline. In this case also it is of the first importance that the application be made when the stone is thoroughly dry and, as far as possible, heated by the sun's rays.

Whichever of the two methods be adopted, it will be necessary to renew the application of the preservative at considerable intervals. If the first brushing over be carefully done, with the stone in proper condition, it will probably not be necessary to repeat the treatment short of at any rate a year or two. It will be well before applying either preservative to give the surface of the stone a good scrubbing with soap and water (to remove soot, etc.), leaving ample time for drying afterwards."

Prof. E. H. Keiser, of Washington University, St. Louis, writes as follows of a method he has developed:

On September 17, last, you wrote me in regard to finding a preservative for marble or other stone, or granite, which could be applied to monuments, etc., in the cemetery to prevent their disintegration by the action of the elements. Shortly after receiving your letter I began some experiments for the purpose of comparing differing preservative agents. I coated slabs of marble with soluble glass or sodium silicate, with cement filler and spar varnish. Then I exposed these slabs on the roof of the chemical laboratory to the action of the weather. During the winter the slabs were repeatedly covered with ice and snow, then thawed out and frozen again and again. Thus far the cement filler and spar varnish have stood the best. The sodium silicate has been pretty well washed and worn away. The varnished slab is practically as smooth and glossy as when first exposed.

I would recommend one coat of waterproofing cement filler, a thin varnish made by the Sherwin-Williams Co., and two coats of spar varnish made by the same company.

CEMENT STAINS ON GRANITE.

Can you suggest a remedy for removing the discoloration from a granite building that is apparently stained by the absorption of the cement? The granite was backed up with concrete made of cement, sand and gravel and set while the latter was very moist.

The Atlas Portland Cement Co. recommend: "A weak solution of hydrochloric acid, say one part of acid to forty parts of water, used as a wash," which they believe will remove it.

"HURRICANE" CLEANER.

"A couple of years ago I bought a granite-cleaning recipe from a man traveling through the country, whose name I cannot recall. I have lost the recipe since and am writing you to ascertain whether you could inform we where I could obtain the same recipe. Hydrofluoric acid is the main chemical; the rest of ingredients I have forgotten."

You evidently refer to the formula known as "Buskey's Hurricane Cleaner," and we reprint from an old issue of MONUMENTAL NEWS some correspondence regarding this preparation:

In your December issue you have an inquiry regarding the chemical used in the so-called "Hurricane Cleaner." It is hydrofluoric acid. Believing that anything that will benefit the trade should be passed around, I enclose the formula:

One part common ammonia; one part cider vinegar; one part sal soda; one part saleratus; one part water; three parts hydrofluoric acid (25 per cent strength). If the acid is over 25 per cent, add more water to reduce it.

To mix, put one part of each ingredient in an open bucket, except chemical, then slowly add the chemical. Do not stir it. After the boiling has stopped put in stone jug and cork.

To use, paint on dry stone with brush. Use plenty of water to wash off with; keep fingers out of it. N. Y. DEALER.

JAVEL WATER AND ITS USE.

"Javel" or javelle water, used for removing stains from marble, is a solution of hypochlorite of potash having a discolorant action. The formula is as follows:

$$\underset{\text{(Potash)}}{2\,O\,H} + \underset{\text{(Chlorine)}}{Cl_2} = \left.\begin{matrix}\text{Cl O K}\\ \text{Hypochlorite}\\ \text{of Potash}\end{matrix}\right\} \text{Javel Water}$$

The following chloruret is another:

$$\underset{\text{Potash}}{2\,O\,H} + \underset{\text{Chlorine}}{Cl_2} = \left.\begin{matrix}\text{Cl O K}\\ \text{Hypochlorite}\\ \text{of Potash}\end{matrix}\right\} + \underset{\text{Chloruret of Potassium}}{K\,Cl} + \underset{\text{Water}}{H_2O}$$

That chloruret is very movable and left under the influence of the weakest acids its chlorine acts as an oxidizer and destroys the colors.

The javel water (improperly javelle) takes its name from an ancient village of the suburb of Paris, now incorporated in the city.

An isolated mill, near the Seine river, called the "Moulin de Yavel" (yavel mill), was the origin of that locality, which became of some importance only in 1777, after the building by the Count of Artois of the manufacture for acids and mineral salts.

The best way to use Javel water for cleaning monuments is to experiment with it, either pure or diluted with water. If for cleaning the whole face of a stone not badly soiled it is not necessary to use the Javel strong but well diluted, and should ink or other discolorations still remain after the first washing, such spots can again be treated with a stronger solution or even of full strength. It is a cheap material and experiments can be made on a small piece of marble and the results duly noted, the idea being that in using Javel water one can gather one's own experience in its use and possibilities.

CHAS. G. CANIVET.

MARBLE CLEANERS.

To remove stains and discolorations from marble boil together a quarter of a pound each of soft soap and powdered whiting and soda for twenty minutes. Spread it on the marble to be cleaned for twelve hours. Then wash it off with clear water. For the ordinary washing of marble use ammonia and water in place of soap suds. To polish black marble, wash it in cold soap suds, dry it with an old cloth and then rub it at least an hour with flannel spread with white wax. To remove iron stains from white marble, try lemon juice. If an oil stain disfigures the surface, apply to it common clay saturated with benzine. Another stain remover is made of two parts of common soda and of powdered pumice stone and one of powdered chalk. Sift it through thin muslin, mix it to a paste with water and spread it over the marble. After ten hours wash it off with soap suds.

* * *

To Remove Stains from Marble—Sift through a fine sieve two parts of soda, one of pumice stone and one of finely powdered chalk, and mix them into a paste with water. Rub this well all over the marble and the stains will be removed; then wash it with soap and water and a bright polish will be produced.

To Remove Stains from Marble, No. 2—Clean the marble with diluted muriatic acid, or warm soap and vinegar. Dissolve in hot water (half gallon) 1½ pounds of potash; add one pound of virgin wax, boiling the mixture for half an hour. Allow it to cool, when the wax will come to the surface. Put the wax in a mortar and triturate it with a marble pestle, adding soft water to the mixture until it becomes a paste. This laid on the marble and rubbed when dry with a woolen rag gives a good polish.

* * *

To clean paint from white marble make a mixture of one part pearlash, three parts lime. Slake the lime with water and add the pearlash, then reduce with water to the consistency of stiff paint. Apply with a fibre brush. When the paint is softened use a stiff brush to remove it and rinse with plenty of clean water.

To remove any discoloration from the oil in the paint boil together one-quarter of a pound yellow soap, one-fourth pound whiting and one ounce of washing soda in water for about 15 minutes to a consistency

of extra thick cream, and rub on the marble while hot. Wash off the next day and if necessary repeat the operation. Finally polish with coarse flannel. To remove ink spots from marble dissolve one ounce of antimony trichloride and two ounces of oxalic acid in one quart of water. Add to the solution enough flour to make a paste. Apply to the spots and leave it on for several days, when the ink will probably be drawn out of the marble.

* * *

In the South, where a great deal of marble is used, the stone is often disfigured by a vegetable growth, and in many instances this growth has died and become brown or black in color. The monumental men remove these discolorations by soda lye, a five per cent solution. The growth which is rotted is dissolved and the remainder is soon disintegrated. In practice a box of concentrated lye, containing about twelve ounces of caustic soda, is dissolved in two gallons of water. The mixture is spread over the stone with a small, cheap scrubbing brush made with vegetable fibre, preferably made with a handle so as to avoid getting the lye upon the hands, the clothes or the shoes. After ten minutes or more water is poured over the stone to wash off most of the lye and then the stone is rubbed a little with the brush, some sand being used if necessary. Almost invariably the stain is removed. This liquid has no effect on the stone itself, and is easily washed away. It improves rather than harms any grass or other plants, but if it remains on the skin it is apt to cause an ugly sore. If splashed upon the clothing the prompt application of sal ammoniac will prevent corrosion of the goods.

In some southern yards when polished marble becomes stained it is cleared without destroying the polish by applying a paste made of equal parts by weight of ox gall, powdered soap and pipe clay, or fine china clay, mixed with turpentine. A thick coating is applied to the stained marble and when dry is rubbed off and the marble washed with warm water. If badly stained the marble is given a second application.

* * *

Sapolio, a little powdered pumice stone, a good quantity of water and a stiff scrub brush generally cleans marble. To clean around raised letters, mouldings and carvings use lump pumice stone and water. Break off small pieces, using a sharp edge whenever possible. To get in the crevices of carvings whittle a piece of wood down to a thin square end, put powdered pumice stone in the crevice and rub with the stick. Stains can partially be removed by putting on a large batch of slack lime three or more inches thick on the stain and leaving for one day. This generally draws the stain out. To use acid one is nearly sure to make the marble yellow. For a deep stain the sure way is to cut a dump in the marble, gradually bringing the edge of the cutting to the surface at a width of eight or more inches. If a dump has been cut to this width it will rarely be noticed.

* * *

"In regard to removing phosphoric acid stains from marble, we have experimented a little to ascertain just what the character of the stains referred to could be. We find on experimenting with this acid that it apparently eats into the marble, destroying the finish and leaving the surface rough and raw. There is no way of remedying this difficulty where it has occurred except by refinishing the slabs. The material which we used did not show any discoloration. It may be some other foreign matter occurred upon the places where the acid had removed the gloss. Very frequently, if an application of high-grade gasoline is applied to a stain or soiled marble, it will remove discoloration. This should be applied on such material with clean white cotton, allowing the waste to remain upon the spot until the gasoline has evaporated. A paste made from chloride of lime and applied to the stains will frequently remove them. We are sorry that we cannot give you anything more definite."

VERMONT MARBLE CO.

"Plaster of paris and chloride of lime mixed, applied to the stains on marble, are the only things we know of that will take them out. Some stains in marble, however, can never be taken out."

TOMPKINS-KIEL MARBLE CO.

The Vermont Marble Company has issuel a very handy and useful little pocket-size memorandum book which contains several pages of valuable practical information about monumental work that take the place of the general information usually found in such books. We quote the following useful hints from the book:

"For nearly all stains, except those resulting from oil, use javel water. This is a simple preparation made from chlor-

ide of lime and washing soda. It can be obtained at any drug store. Frequent and copious applications of this liquid will usually restore the marble to its natural condition. It may also be used to good advantage when dirt has become hardened on the surface.

"Some few things like iron rust and creosote cannot be erased. Others are conquered with difficulty if allowed to stand for a long time. Therefore, if spots of any kind are discovered, they should be removed at once if possible.

"When the stain comes from oil, gasoline of good quality should be used. Be sure the gasoline is of the best grade, otherwise the result may be disappointing. Saturate cotton waste or blotting paper and press it firmly down on the marble. Allow it to remain for a day or two if necessary, wetting it often with gasoline. The process may be accelerated by the introduction of sunlight or some form of artificial heat.

"There is nothing better than javel water for ordinary stains, or than gasoline for oil spots. When these prove ineffective the only thing to do is to set the monument out in the open and trust to the action of the sun and frost. This will sometimes succeed when all else fails.

"Every cemetery memorial should be cleaned with javel water once or twice a year, and all the dirt and moss that has started to collect should be removed. If foreign substances are allowed to accumulate, they absorb moisture. This tends to roughen the surface and, in turn, invites the absorption of more moisture. Keep the marble smooth and uncoated and this damage will be averted.

"The monument that has once become roughened can best be restored by thorough treatment with pumice stone or fine grit. It is a practice more or less general to use as a renovator a weak solution of muriatic acid. This should never be permitted. The immediate results may appear to justify the treatment, but in the end you will find that the stone has been greatly injured."

* * *

Julius Lubking, 1507 East Baltimore street, Baltimore, finds that about the best and cheapest way to remove weather, wood and sacking stains from marble is to apply a good coating of whitewash, while it is still hot from the slaking process. He states that this will do the work within a very few hours if the stains are not too deeply set; in those cases, a second or perhaps a third application will be necessary.

* * *

MISCELLANEOUS RECEIPTS FOR CLEANING.

There sometimes arise occasions where a little special knowledge is imperative, and we here publish the following formulas, receipts and shop wrinkles for the easy accomplishment of certain unusual tasks. These items are recommended by persons who have tested them out, and while we cannot vouch for their reliability, they will assuredly be worth trying.

To Clean Brass and Copper.—With sufficient water to make a paste combine 1 oz. oxalic acid, 6 oz. rotten stone, ½ oz. gun arabic, all in powder, and 1 oz. sweet oil. Apply a small portion, and rub dry with a flannel or leather.

Cleaning Brass Inlaid Work. — Equal parts of tripoli and linseed oil make an excellent polish to be applied with a piece of felt.

For Polishing Hardwood Cases.—A paste made of rotten stone, a pinch of starch, sweet oil and oxalic acid, mixed with water, is excellent.

Unslacked lime is a capital thing to clean steel with. Steel tools and implements kept in quicklime will seldom rust.

For removing stains: Mix equal parts by weight of fresh ox gall; pulverized soap and pipe clay (kaolin) with enough turpentine to produce a thick paste. Apply to the stain in a heavy layer, which when dry remove and wash the spot with warm water. Fresh ox gall furnished by any beef butcher should always be used, the prepared article has not the proper strength.

An effective cleanser and polish: Dissolve four ounces of sal soda in as little water as possible. Make a paste with this solution by adding two ounces of levigated pumice and two ounces of fine chalk to it. If the pumice and chalk do not unite readily with the solution, add sufficient water. Rub the stone well with this, using a coarse cloth, then wash with soap and water. A fine polish should be obtained.

To restore polish destroyed by muriatic acid: The better method is to use hard pumice with very fine white sand and plenty of water. If the acid has not penetrated deeply the sand may be omitted but plenty of water must be used. The rubbing should be done by a rotary motion,

preferably by a polisher. The chief point is to obtain an even surface, otherwise the results will be unsatisfactory. When the surface has been rubbed sufficiently with the above, a compact linen cushion may be used for polishing, the cushion being well saturated with water and the stone rubbed with this until a good polish is had. To give it a brilliant gloss, wash the prepared surface and let it dry, then take a clean linen cushion, moisten it with a little water and dip into powder of purest quality of calcined tin. Rub for some time and complete the operation by rubbing the work lightly with another cushion of soft material.

OIL AND VARNISH REMOVERS.

Make a paste from chloride of lime, sal soda and water, and apply to the spots one-quarter of an inch thick. Allow it to remain for a few days, then remove it and wipe the spots with cold water. If the spots have not disappeared repeat the dose. Rinse well.

Another method is to apply a paste made from carbonate of magnesia and ether, or from calcined magnesia and tetrachloride of carbon. Should any of these methods only partially do the work, a treatment with soft soap, soda solution or liquid ammonia will no doubt do the rest.

* * *

The following is recommended for removing oil from granite: "Place a coating of powder over the oil, then dampen with gasoline and light. The powder may be calcined plaster or whitening."

* * *

Crude petroleum stains, it is said, are best extracted by saturating pulverized pipe clay, fullers' earth or whiting with benzine and place a layer of this mass over the stain letting it remain until almost dry. Then remove, and if stain still remains, repeat the operation.

Another effective means is to mix three parts by weight of soap, six parts of fullers' earth, and three parts of potash with enough boiling water to make a thick batter that is applied in a heavy layer to the stain and left on for two or three hours.

Still another method is to make a mixture of two parts by weight of sal soda, one part of chalk and one part powdered pumice, all ground together in water and applied as a paste, which when dry is removed and the spots washed off with soap and water.

To remove oil stains from granite—Mix gasoline and plaster of paris into a thin paste and put it on the stained parts to the thickness of one or two inches. Remove when dry. If the stain has been on very long two or three applications may be necessary. Gasoline should be used out-of-doors or not near a fire.

* * *

"We have had good success in drawing out oil stains from marble and granite by placing a coating of powder over the oil and then dampen with gasoline and light. This is the best way we know of to remove oil. The powder may be calcined plaster or whitening."

W. F. and P. A. Lennon.

* * *

To remove oil spots—Saturate fuller's earth or whiting with gasoline or benzine, apply the resultant soft paste to the spots, permitting it to remain until dry, then remove. If stains have not disappeared apply another layer. If stains are stubborn moisten the paste with benzine as fast as it drys.

REMOVING RUST OR INK.

For hickeys or other small pieces rust spots may be removed by boiling them in a strong solution of caustic soda. Remove the stone from the solution and rub well with a coarse cloth. Rinse in lukewarm water and the rust will have disappeared. For large work make a paste of pipe clay or kaolin by mixing it with one and one-half ounces of fresh ox gall, one and one-half gills of lye, and two tablespoonsful of turpentine. Apply the paste to the spots and allow to remain two or three days, then remove the dry paste.

* * *

Dissolve in one pint of rain water one ounce oxalic acid and one-half ounce antimony trichloride. Mix with sufficient flour to make a soft paste. Apply with a brush; permit paste to remain on spot for several days, then wash off.

WEATHER STAINED WORK.

For simple weather stains mix five parts by weight of sal soda, two and one-half parts pulverized chalk or bolted whiting, and two and one-half parts of levigated pumice in water. Dissolve the soda in hot water and add the other ingredients afterward. With this mixture, which should be

the consistency of cream, scrub the stone with a coarse brush. When the stain is well removed wash with soap and water. If this does not do the work effectively, rubbing with fine sand and bricks must be resorted to.

COMMUNITY MAUSOLEUM PATENT DECISION.

In view of the emphasis which the community mausoleum promoters place on their so-called patented construction of crypts, exclusive rights to which are granted to the local companies or cemeteries they induce to take up the building, it is interesting to note a decision of an Ohio court declaring the original Hood patent invalid. The International Mausoleum Co. brought suit against H. S. Sievert and others for infringing their patents. Judge John M. Killits, of the United States District Court, Western Division of the Northern District of Ohio, in declaring the patent invalid, renders the following decision:

This case is before the court on demurrer to the bill of complaint. Complainant alleges that defendants are infringing a patent owned by it and granted to W. I. Hood, assignor of one-half to John W. Chesrown, June 25, 1907, No. 858,070, for a burial crypt, a copy of the patent being attached and made a part of the complaint as an exhibit.

The court, in Fowler vs. City of New York, 121 Fed. 747, a case wherein proffer only of the patent in the following langauge was made: "Which said letters patent or an exemplified copy thereof your orator will produce as Your Honors shall direct," held that the patent is, therefore, to be "regarded as a part of the bill and will be examined on demurrer."

Seventeen grounds of demurrer are specified. We will consider ground 15 and 16 only, which are: that the "patent was granted and the claim of said patent was allowed for matter for which the Commissioner of Patents had no authority in law to grant a patent or allow a claim," and "that said Exhibit A shows on its face that said letters patent No. 858,070 is invalid."

We are not unaware that there is a presumption of validity of a patent so strong that it is improper to hold one invalid on demurrer, unless it so clearly appears to be invalid that no testimony can change the legal aspects of the case. But when these considerations exist, the question of validity may be raised by demurrer, and the case may be determined on the issue so formed. (Richard v. Chase Elevator Co., 158 U. S., 299.) And manifestly, in considering the question, we may not take cognizance of anything de hors the record, excepting such matters as are of the stock of common knowledge; wherefore we are unable to consider the prior art as invited by demurrants. But, considered in the narrow light constraining us, we find little difficulty in reaching the conclusion that the patent in question is invalid on its face.

The claimant says in his application and specifications:

"This invention has relation to burial crypts, and it consists in the novel construction and arrangement of its parts as hereinafter shown and described.

"The object of the invention is to provide a community crypt having a hallway or lobby of sufficient size to accommodate the funeral attendants and which will protect them during the services, from extreme temperatures in the weather and also from storms."

This is the only expression of the patentee concerning the purpose and scope of his invention, although further along in the specifications he describes some results that may be obtained through the operation of his devices: the only ones of which appearing novel to us will be discussed later.

The specifications and claims are manifestly drawn with a lack of clear understanding of the meaning of terms for beyond any question the word "crypt," throughout the entire letters patent, is used to designate a building housing receptacles for the bodies of the dead. The use of the word in the specifications meets no definition in any standard dictionary. The patentee used it in the sense of a burial building or, as it is commonly known in the art now, of a mausoleum. He specifies that his crypt "comprises the hall or lobby (1) of sufficient size to accommodate a funeral train," with "catacombs"—"arranged in vertical rows, tier upon tier, and separated from each other by homogeneous partitions, preferably of concrete cement and homogeneous tops, the lower surface of the floor of one set of catacombs forming the tops of the next set of catacombs below."

As we said of the use of the word "crypt," so we may say that he uses the word "catacombs" in a sense not found in

any standard dictionary defining the word. Except that the structure upon which he claims a patent is above ground, we might say that the careless draughtsman of these specifications was reversing the use of the terms and spoke of catacombs when he meant crypts and of crypts when he meant catacombs.

It is certainly settled that, understanding that when the patentee speaks of "burial crypts" he means a building erected on the surface of the ground with central hallway and burial receptacles arranged on each side, he is dealing with a subject that is not patentable. Such a construction is neither a new or useful art, machine, manufacture, or composition of matter, or any new or useful improvement thereof, or any new, original or ornamental design for any article of manufacture. The doctrine of Jacobs vs. Baker, 7 Wall., 295; Fond du Lac County vs. May, 137 U. S., 395; American Disappearing Bed Co. vs. Arnaelsteen, 182 Fed., 324, settles this point. In the first two cases above it was held that an improvement in the construction of a jail, being a building, did not come under the description of things subject to a patent covered by Section 4886, Revised Statutes of the United States. And, without the authority of these cases, it is common knowledge that the older countries present many instances of burial places under roof with provision for the accommodation of funeral attendants, protecting them during services from the weather, with receptacles for the dead. The world has general knowledge of the construction and arrangement of the catacombs in Rome, and of churches and burial places generally which make provision similar to that which the inventor Hood says is the object of his invention.

The specifications provide for a construction by which the "catacombs," pass the gases and volatile products of decomposition into a common chamber, from which they may escape into the outer air and disseminate. This is one of the claimed novel features of the invention. This may be a novel result, but the devices by which it may be accomplished cannot be said to be useful, for the dissemination of the offensive volatile products of decomposition of the human body into the atmosphere is hardly desirable, if, indeed, it is sanitary. We do not feel that we can say that a result so likely to become a nuisance can be subject of patentable invention.

The means of escape of the gases of decomposition from an individual "catacomb" is through a "valve port" in the rear. No description is offered or claim made for any novel valve, nor is any form of valve in fact shown, but we are led to understand that any gas pressure relief valve may be employed. This device is an old one as applied to analogous purposes, and consequently, is not invention, standing by itself, in view of the decision in Blake vs. San Francisco, 113 U. S., 682.

The inventor also provided each "catacomb" with a port in the front end through which he says the air may be "exhausted from the interior of the catacombs when the casket is first deposited therein." It does not appear from the specifications or from any description that any advantage inures in exhausting the air from a "catacomb" after the deposit of a casket, and it is a matter of common knowledge that a "catacomb" constructed preferably of concrete cement would not suffer the continuance of a vacuum within it for any appreciable length of time, as the porosity of concrete is undoubted.

The claims are as follows:

1. A burial crypt comprising a structure with a reception hallway, seamless catacombs arranged therein and spaced from the walls thereof whereby an air passage is formed, said catacombs being provided with valve-controlled ports at their ends which communicate with the said air passage having an outlet at, or near, the top of the structure.

2. A burial crypt comprising a structure with a reception hallway, seamless catacombs located therein and spaced from the walls thereof whereby an air passage is formed, said catacombs being provided with valve-controlled ports at their rear ends which communicate with said air passage, said passage being provided with an outlet at or near the top of the structure, also valve-controlled ports at the front ends of the catacombs through which the air may be exhausted therefrom after the same are sealed.

3. A burial crypt comprising a structure with a reception hallway, seamless catacombs located therein and spaced from the walls thereof whereby an air passage is formed, said catacombs being provided with valve-controlled ports at their rear ends which communicate with said air passage, said passage being provided with an outlet, at or near the top of structure,

also valve-controlled ports at the front ends of the catacombs through which the air may be exhausted therefrom after the same are sealed and a horizontal shelf in front of each row of catacombs, the upper surfaces of the shelves lying in the same plane as the upper surfaces of the bottoms of the catacombs.

It will be observed that these several claims are generally each for an aggregation of non-co-operating elements, each of which is non-patentable. It cannot be said, as the court in Pickering vs. McCullough, 104 U. S., 318, says that all the constituents so enter into the combination that each qualifies the other. As observed by counsel for demurrants, there is no joint or co-operating action between a reception hallway and the gas pressure relief valve, for the latter will operate, if it operates at all, indifferent whether the services are held in the reception hallway or dispensed with, or whether the gas container whose undue pressure it is to relieve is on a shelf in a receiving vault or out of doors Nor is there any co-operating action between the horizontal shelf claimed in the third claim, which, in the specifications, the claimant says "may be used for the support of floral designs and appropriate emblems," and the gas pressure valve.

There is no patentability in the idea of a burial crypt (meaning a burial building) with a reception hallway, nor does the inclusion in such an edifice of seamless catacombs (meaning homogeneous burial crypts or niches for the deposit of individual bodies), bring about a patentable invention, for it is notorious that the sides of the corridors in the Roman catacombs were lined with burial niches cut into the solid rock or tufa, and, consequently, they were "seamless" in the walls.

Aside from the lack of co-operation between valve-controlled ports and the arrangement of the catacombs (crypts) on the sides of a central hallway, which we have noticed, ports in a sealed crypt to permit the escape into the open air of noxious and perhaps poisonous effluvia cannot receive the sanction of a patent as a useful invention, and we may say that a port through which air may be exhausted from a chamber is not new and in combination with other elements aggregated in these claims it adds nothing for want of necessary co-operation as well as not serving a purpose specified to be useful.

A shelf in front of a "catacomb" on which a casket may be rested and which may also support flowers or memorial designs has, as an element of combinations, already been noticed. Being but an enlargement of the base of the portal, it is old.

Looking at these specifications as a whole, we are forced to criticise them as being so vague and ambiguous in their terms as to need extensive reconstruction in order to be understood and to constitute a source from which any plausible theory of the operation of the patentee's alleged invention may be deduced.

If the growth of the patent system at the time of the decision of Merrill vs. Yeomans, 94 U. S., 568, has reached a stage in its progress which warranted the court in saying that there was no longer "excuse for ambiguous language or vague descriptions," we may at this time speak even more strongly and say that an invention depicted in such slovenly and ill-considered and inconclusive language as this is not yet ready for protection by letters patent.

We consider that the alleged patentee's right to protection by letters patent is concluded against him by the cases above (Fond du Lac County vs. May and American Disappearing Bed Company vs. Arnaelsteen), and that the demurrers should be granted cause of the invalidity of the letters patent.

COUNTY SOLDIERS' MEMORIAL LAWS.

First among practical measures to be considered in the erection of soldiers' memorials are ways and means of raising funds. Money must be raised by voluntary contributions or by the appropriation of public funds, or both. States and large cities will undoubtedly in many cases erect imposing memorials from public funds. In most cases, however, especially in rural communities and in the smaller cities and towns, voluntary contributions will necessarily be resorted to. In many cases unless vigorous personal work is done by leading citizens sufficient funds will not be at once forthcoming, and interest will wane. As time goes on, it will be still more difficult to complete funds unless public appropriations may be drawn upon. The simplest and most direct method of distributing the cost of a memorial over the entire community is by taxation, but in most cases state legislation is necessary

to permit raising funds for such purposes by taxation. State laws have been passed providing that towns, counties, cities or other local political units may be permitted to levy taxation for the erection of soldiers' memorials, and it is of the highest importance that these acts be so worded as to provide for the erection of real memorials that memorialize and not so as to permit thriftless public officials to foist public buildings upon the people in the guise of soldiers' memorials. Some laws are not so worded, for they permit the erection of either buildings or monuments, and efforts should be made to have them amended so as to provide exclusively for ideal memorials that memorialize and do nothing else.

In all such laws the section referring to the memorial should be so worded as to provide for "the erection of a suitable ideal memorial that shall give visible symbolic expression of the heroism of our soldiers and sailors in the great world war, and express in monumental form our gratitude for their bravery and sacrifices; a memorial that shall be exclusively a tribute to our heroes and shall serve no commercial or utilitarian purpose, but shall be an ideal work of memorial art so designed that it shall be recognizable by all as an expression of the deeds of our soldiers and sailors."

Every state should have a law similar to this, as a public appropriation secured in this manner will insure the raising of sufficient funds in rural communities to provide a worthy memorial.

With a law similar to this on the statute books every community can easily have a memorial. So that the law should provide, however, for a proper form of memorial, those interested in securing real memorials should take the lead in the matter and see that properly worded bills are presented to their legislatures so that the public building propagandists may not use these measures for the erection of utilitarian buildings in the guise of memorials.

A bill for the purpose of erecting memorials to soldiers of the Civil War by similar means was passed several years ago in Iowa, and has been the means of erecting numbers of public memorials that would not otherwise have been erected.

Such laws can be of great benefit in securing the erection of public memorials, but too much stress cannot be laid upon the necessity of getting laws that are properly worded to secure real memorials of worthy artistic form.

In some cases, as in Oregon, county courts are permitted to appropriate a sum specifically limited in amount to $5,000; in the Illinois bill, provision is made for popular vote both on the amount to be expended and on the character of the memorial; in the Wisconsin bill the County Board is permitted to levy a tax not exceeding two-tenths of a mill on the assessed valuation of taxable property; in Minnesota, counties with a population of not over twenty thousand may appropriate $10,000, and counties having a population of from twenty to a hundred thousand, may appropriate $20,000 to erect or assist in the erection of a monument.

As to which of these methods of fixing the amount is used is a matter to be decided by legal advice in each state, or the advice of the legislator who is to handle the matter.

The section of the act, however, regarding the monument, after the proper phraseology regarding the county levying or appropriating a certain amount on a certain portion of taxes, is fixed, should include the wording noted above.

If this section is worded in this form it will effectually prevent memorial funds being used for the erection of City Halls, Court Houses, bridges, public halls or other selfishly utilitarian structures.

The Oregon state law, which has been passed and is now in force, reads in full as follows:

SENATE BILL NO. 121.

Introduced by Senator Handley.

A BILL for an Act to empower the several county courts of the State of Oregon to expend a limited amount of the county funds in erecting or assisting its citizens in erecting a proper and suitable arch or monument of permanent material, to the memory of the soldiers and sailors who served in the Great World War.

Whereas, A great sacrifice and service for our country and the cause of humanity has been made by soldiers and sailors of this State in said war, and

Whereas, Many have made the supreme sacrifice in the cause of humanity and democracy; and

Whereas, It is fitting and proper that suitable monuments should be erected in every county to their memory, therefore

Be It Enacted by the People of the State of Oregon:

Section 1. That the county courts of the several counties of this State are hereby authorized and empowered to pay out of the county funds a sufficient sum to erect or assist its citizens in erecting a proper and suitable memorial arch or monument of permanent material to the memory of the soldiers and sailors of said county who served in the late World War in a sum not to exceed $5,000.

Section 2. Such memorial shall be erected and constructed under the supervision of the several county courts and shall be located at the county seat and placed upon property of the county.

A proposed Wisconsin bill reads in full as follows:

SENATE BILL NO. 18.

Introduced by Senator A. J. Pullen of Fond du Lac.

A BILL to create section 45055 and subdivision (12n) of Section 670 of the statutes, authorizing counties, towns, cities and villages to appropriate money for monuments or memorial buildings to the deeds and memory of the soldiers and sailors who served the nation in the war with Germany.

The people of the State of Wisconsin, represented in senate and assembly, do enact as follows:

Section 1. A new section and a new subdivision of section 670 are added to the statutes to read: 45055. Any town, city or village by its respective board or council may determine to erect a suitable monument or memorial building to the deeds and memory of the soldiers and sailors who served the Nation, during the war with Germany, and for that purpose may appropriate out of the general funds of said town, city or village, or levy a tax therefor, a sum not exceeding five-tenths of a mill of the assessed valuation of all the taxable property in said town, city or village in the year in which said appropriation is made or tax is levied.

Section 670 (12n) The county board of every county is hereby authorized to appropriate from its general fund or to levy a tax for the erection of a suitable monument or monuments, memorial building or buildings, to the deeds and memory of the soldiers and sailors who served the nation during the war with Germany, or to contribute to the erection of such monuments or buildings by one or more of the towns, villages or cities, in said county a sum not exceeding two-tenths of a mill upon the assessed valuation of all the taxable property in said county in the year in which said appropriation is made or tax levied.

Section 2. This act shall take effect upon passage and publication.

The Minnesota bill has passed and reads in full as follows:

HOUSE BILL NO. 98.

Introduced by Representative W. C. Briggs of Pipestone and Senator Nordlin.

A BILL for an act to amend Subdivision 10 of Section 696 General Statutes 1913, relating to an appropriation by certain counties for a soldiers' and sailors' monument.

Be it enacted by the Legislature of the State of Minnesota:

Section 1. That subdivision 10 of section 696 General Statutes 1913 is hereby amended to read as follows:

Section 10. To appropriate in counties having a population of not more than twenty thousand a sum not exceeding ten thousand dollars, and in counties having a population of more than twenty thousand and less than one hundred thousand a sum not exceeding twenty thousand dollars, to erect or aid in erecting a monument or other memorial to the soldiers and sailors of the nation, such monument or other memorial to be constructed on the courthouse square, or in a public park at the county seat, if there be one.

Sec. 2. This act shall take effect and be in force from and after its passage.

A proposed Illinois bill reads as follows:

SENATE BILL NO. 64.

A BILL for an act to authorize counties having a population of less than three hundred thousand (300,000) to erect monuments or memorials in honor of their soldiers and sailors who participated in the war of 1917, 1918 and 1919.

Section 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly: That whenever electors in any county equal in number one-twentieth of the total number of votes cast for county judge in said county at the latest preceding election for such offices shall petition the county judge of the county court of any county not over three hundred thousand in population to submit to a vote of the electors of such county a proposition to erect and maintain a monument in honor of its soldiers and sailors who served during the war 1917, 1918 and 1919 as hereinafter provided in this Act; it shall be the duty of such judge of the county court to submit such proposition to a special county election to be called by such judge within sixty days thereafter: Provided, that if there be a general county election to be held in such county within ninety days that no special election shall be called but that said proposition shall be submitted at such general election. An order shall be entered by the county judge and recorded in the county court of such county ordering the county clerk to submit such proposition as aforesaid at such election: Provided, further, that if there be any cities, villages or incorporated towns within such county which have adopted "An Act to amend an Act entitled, 'An Act regulating the holding of elections and declaring the results thereof in cities, villages and incorporated towns in this State,'" approved June 19, 1885, in force July 1, 1885, and all amendments thereto, then such county court shall order the board of election commissioners for such cities, villages or incorporated towns to submit said proposition on the ballot at said election within such cities, villages or incorporated town. Upon the entering of such order it shall be the duty of the election officials in such cities, villages or incorporated towns, and the county clerk in the counties to submit such proposition in conformity with the general election laws in the State of Illinois, except where otherwise especially provided.

Sec. 2. Said petition provided for in section 1 shall be in the following form:

To the Honorable (name of judge), judge of the county court of the county of (name of county).

We, the undersigned qualified electors of the county of (name of county), respectfully petition your honor to submit to a vote of the electors of said county at an election, the following proposition:

Shall the county of ..... erect a ..... as a memorial in honor of the soldiers and sailors of the war of 1917, 1918 and 1919, the original cost of which shall not exceed $.....?

Signature	Number Street	Town or City

I, ..., do hereby certify and make oath (or affirm) that I am upwards of twenty-one years of age; that I reside at number ..... street, in the village of (or city) ....., of the county of ..... and State of Illinois, and that the signatures on this sheet were signed in my presence and are genuine; and that to the best of my knowledge and belief the persons so signing were at the time of signing said petition qualified voters of the county of (name of county) and that their respective residences are correctly stated as above set forth.

.....

Subscribed and sworn to before me this..... day ....., A. D. 19...

(Seal, if officer has one.)

.....

(Official character.)

Such petition shall conform to the general provisions of the election laws of this State pertaining to such or similar petitions. Such petitions shall be sworn to before some officer of the county in which the proposition is to be submitted, authorized to administer oaths therein.

Additional petitions may be filed up to the twentieth day before the date set for any election called as herein provided.

Sec. 3. The ballot at such election shall be in the following form:

Shall the county of ..... erect a memorial in honor of the soldiers and sailors of the war of 1917, 1918 and 1919, the original cost of which shall not exceed $.....?	Yes	
	No	

Provided that there shall be inserted in said proposition an amount equal to the largest sum named in any petition filed with the county judge.

Provided, further, that following the above proposition on the ballot all types of memorials which may be designated in any petitions filed as herein provided, shall be listed so that each elector may express his choice, by putting a cross in the square in front of the type he favors, which list shall be substantially in the following form:

VOTE FOR ONE.

☐ ARMORY
☐ BOULEVARD
☐ BRIDGE
☐ .....
☐ .....

Sec. 4. The judge of such county court shall give at least ten days' notice of the election at which such proposition is to be submitted, by publishing such a notice in one or more daily newspapers, published within such county for at least five consecutive days, the last publication of which shall be not less than ten days before the election, and if there be no daily newspaper in such county, then by publishing such notice two consecutive weeks in one or more weekly newspapers, the second publication to be not less than ten days previous to the date of such election. Such election shall be held under the election laws in force in such county or in the different cities thereof except as otherwise herein provided.

The proposition shall be on a separate ballot from the one on which is printed the names of candidates for office, if such proposition be submitted at the general election, but it need not be on a ballot separate from other propositions. The proposition shall be printed in prominent type of not less than one-eighth inch in height and such ballot and the manner of voting the same shall comply as nearly as may be to section 16 of an act entitled, "An Act providing for the printing and distribution of ballots at public expense and the nomination of candidates for public offices, to regulate the manner for holding elections and to enforce the secrecy of the ballot," approved June 1, 1891, and in force July 1, 1891, and all amendments thereto.

If the majority of the votes cast "Yes" or "No" on such proposition be in favor thereof, it shall be the duty of the county board or commissioners of such county, within one year after such election, to appropriate such funds as may be necessary to erect a suitable monument or memorial and, if necessary, to provide a site therefor.

Such monument or memorial may take the form of a public edifice, park, boulevard, bridge, armory, or such structure as may receive the highest number of votes from the voters who, by the means herein provided, express a choice as to the type of structure.

Such monument or memorial shall be under the supervision and control of the county board or commissioners, but it shall be for the free use of the public. The county board or commissioners is hereby authorized to make such appropriation from time to time as may be necessary to maintain and operate such monument or memorial.

Sec. 5. The returns of such election shall be canvassed by the same authorities as canvass returns of the general county elections.

Sec. 6. The county clerk shall, at the first meeting of the county board of commissioners, after such election, file with the chairman of said county board or commissioners a certificate of the result of such election, whereupon such chairman shall name a committee of not to exceed five members to investigate the cost of a suitable memorial and to report at the next succeeding regular or special meeting of the county board or commissioners.

Sec. 7. The county board or commissioners may issue bonds for any part or for all of the cost of the construction of such memorial without submitting to the vote of the people the proposition of whether or not such bonds may be issued: Provided, that such bonds shall be issued to mature in not less than ten or more than twenty annual series, the last series to mature in not more than twenty years from the date of issue.

Sec. 8. The county clerk shall, at least three days before the election hereinbefore provided for, cause a copy of the official ballot hereinbefore provided for to be published once in three newspapers in the county if there be so many published in such county, or if there be no newspaper published in such county the officials in charge of the publication of the official ballot shall cause three sample ballots to be posted in each of the voting precincts in such county at least three days before such election.

Sec. 9. Whereas, an emergency exists, this Act shall take effect immediately upon its passage.

In the state of Iowa a similar law for the erection of memorials to soldiers of the Civil War was enacted several years ago and has been the means of erecting a number of soldiers' memorials that would not otherwise have been erected.

This law reads as follows:

Sec. 430. Dependent Soldiers' and Sailors' Tax—Erection of Monuments. That the law as it appears in section four hundred thirty, supplement to the code, 1913, be and the same is hereby repealed and the following enacted in lieu thereof:

A tax not exceeding one mill upon the dollar may be levied by the board of supervisors upon all taxable property within the county, to be collected at the same time and in the same manner as other taxes, to create a fund for the relief of, and to pay the funeral expenses of honorably discharged, indigent United States soldiers, sailors and marines, and their indigent wives, widows and minor children, not over fourteen years of age, if boys, not over sixteen, if girls, having a legal residence in the county, or for the erection or maintenance of monuments or memorial halls in any cemetery or public place in the county, or across the line in an adjoining county where such cemetery is used chiefly by the inhabitants of the county voting the tax, except that where it is contemplated to erect any such monument or memorial hall within the corporate limits of any city or town, public park or public square, the consent of the city or town council, or park commissioners, as the case may be, having jurisdiction thereof, shall first be obtained; said fund to be expended for the purposes aforesaid by the joint action and control of the board of supervisors and the relief commission provided for by section four hundred thirty-one of the code.

Sec. 435. Soldiers' Monuments and Memorial Halls—Tax for—Inscriptions.

Whenever a petition shall be presented to the board of supervisors of any county, signed by a majority of the members of the grand army posts therein, asking it to submit to the voters of such county, at the next general election thereafter, the question of aiding in the erection of a soldiers' and sailors' monument or memorial hall, the same shall be ordered by such board. The board shall cause the proposition to be printed and placed upon the ballots, and the election shall be conducted in the manner provided in case of similar or like propositions in the chapter on elections.

If a majority of the votes polled is in favor of the adoption of the proposition, then such board, at the time of levying the ordinary taxes follow-

ing the election, shall levy the same, which levy shall be placed upon the tax list and collected as other taxes. The tax thus voted shall not exceed one mill on the dollar upon the assessed valuation of the taxable property within the county. If a monument shall be erected, then there shall be inscribed thereon, or, if a hall be erected, recorded therein, the names of all deceased soldiers and sailors who have died or may hereafter die, and who enlisted or entered the service from the county, and such other names of soldiers and sailors as may be directed by the grand army posts of the county.

The State of Nebraska has also passed a similar law, which was successfully promoted by the Monument Dealers' Association, and which reads in full as follows:

SENATE FILE NO. 18.

A bill for an act to authorize the erection of statues and monuments commemorating the services of the soldiers and sailors of the Civil, Spanish-American and World Wars, by counties, townships, cities and villages, and to repeal Sections 5224 and 5225 of the Revised Statutes of Nebraska for 1913. Introduced by Senator Charles A. Chappell.

Section 1. All counties, townships, cities and villages of Nebraska are hereby authorized to erect or aid in the erection of statues, monuments, or other memorials commemorating the services of the soldiers and sailors of the Civil, Spanish-American or World Wars, to be located upon the public lands or within the public buildings within such county, township, city or village.

Sec. 2. The Board of Supervisors or Commissioners of any county, the electors of any township at the annual or special township meeting, the Commissioners, Council or Trustees of any city or village, may by proper resolution, motion or ordinance decide to erect, or aid in the erection of, any such statue, monument or other memorial. Such resolution, motion or ordinance shall specify the general features and plan of such statue, monument or other memorial, its proposed location, its probable cost and the amount thereof to be paid by such county, township, city or village; the resolution, motion or ordinance shall thereafter be published once in the official paper of the county, city or village and twenty days after the date of the publication the proper authorities shall be authorized and are hereby empowered to levy a tax, in addition to the taxes otherwise authorized to be levied, upon the taxable property of such county, township, city or village, to pay the amount so to be paid by such county, township, city or village, in like manner as general taxes are levied, or to pay such amount from the general fund.

Sec. 3. No money shall be so raised or expended as provided in Section 2 hereof, until the expiration of twenty days after the passage or adoption of such resolution, motion or ordinance authorizing the same, and if within that time a petition shall be filed with said Supervisors or Commissioners of the county or the Commissioners, Council or Trustees of the city or village, signed by fifteen per cent of the legal voters of said county, city or village, asking that such proposition be submitted to a vote of the people, then such proposition shall not become effective until it shall have been approved by a majority of those voting thereon at the next general, special, city or village election held more than thirty days after the filing of said petition, and such proposition shall be submitted to a vote of the people of the county, city or village upon filing of such petition.

Sec. 4. Whenever there shall be filed with any Board of Supervisors or Commissioners of the county, or the Commissioners, Council or Trustees of the city or village, a petition signed by ten per cent of the voters of such county, city or village, asking for the erection, or aid for the erection of any such statue, monument or other memorial, and describing the same as hereinbefore set forth, the Supervisors or Commissioners of the county or the Commissioners, Council or Trustees of the city or village shall without delay proceed therewith, subject to the referendum petition of fifteen per cent of the voters, as provided in Section 3 hereof, or shall without delay provide for the submission of such proposition to a vote of the people at the next general, special, city or village election occurring not less than thirty days after the filing of such petition, and if, when so submitted, it shall be approved by a majority of those voting on such proposition it shall be proceeded with.

Sec. 5. Propositions submitted to a vote of the people under this act shall be submitted in like manner on the ballot as under the general initiative and referendum law.

Sec. 6. That Sections 5224 and 5225 of the Revised Statutes of Nebraska for 1913 are hereby repealed.

Tennessee has also passed a similar law. County courts in Tennessee are authorized to appropriate as much as $25,000 as a fund for the erection of a suitable memorial to the living and dead American soldiers who served in the World War. This is provided in a bill introduced in the legislature by Representative S. M. Leath, of Anderson and Morgan counties, and which has been enacted into law by the legislature.

The bill, which applies to all counties in the state, provides that all money appropriated shall be used exclusively for the erection of a suitable memorial. It is further provided that before any part of the appropriation shall be paid out of the county treasury there must be filed with the county trustee a detailed estimate of every cost and expense of the memorial and that detailed vouchers must be approved by the county judge.

It is stated in the bill that five reputable citizens over twenty-one years of age shall be elected by county court, who shall constitute a county commission whose duty it shall be to superintend the construction of the memorial.

No part of the fund is to be used for the purchase of land, the bill provides, and all persons accepting custody or control over all or part of the appropriation, who misappropriate any part of the fund, shall be guilty of a felony and upon conviction shall be sentenced to the state penitentiary for from one year and a day to two years, which penalty may be commuted to six months in the workhouse, and be fined $50, which when collected shall be paid into the county school fund.

CELTIC INTERLACED ORNAMENT.

It is well known that the intricate and beautiful designs generally called "Celtic interlacing work" are used with endless variety on all remains of ancient Irish art, whether in stone, metal work, or illuminated manuscripts. A remarkable discovery of the principle underlying all such designs—the foundation on which the ancient artists invariably worked—was some years ago made in Ireland.

The greatest living authority concerning Celtic art and history, Miss Margaret Stokes, has proved that the notion which so long prevailed, that the interlaced work which marks early Christian art in Ireland originated there, "must be forever abandoned." "Certain varieties of such designs," she adds, "were developed in Ireland, and if they were to appear in any part of the Continent . . . it would be on the tombs of the founders of Irish monasteries on the Continent. But these Irish varieties do not appear on the tombs of Columban and his followers at Bobbio. The interlacings on the marbles are in no way different from those which overspread Italy in the period of Lombardic-Romanesque architecture, before the sixth and seventh centuries. It would be difficult to prove that any such designs prevailed in Ireland before the seventh century. They are not found on pre-Christian remains in that country, although they are in Italy. They appear to have been gradually introduced into Ireland along with Christianity at a time when this style still lingered in the south of Europe."

This ornamentation may therefore be called Italo-Bizantino, or Lombardic-Romanesque, since, in the periods so termed by authorities on the history of Italian architecture, "interlaced bands, knots and other designs which we are accustomed to call Irish and Celtic are of frequent occurrence, and in places whose history is not connected with that of any Irish missionary we know of." It is found, in precisely similar designs to those abounding in Ireland, on a door of San Clemente, at Rome, A. D. 650; on a balustrade of the ninth century of Sta Maria in Trastevere, and on many fragments preserved in the Lateran and other museums.

There is no doubt, however, that when introduced (probably in the seventh century, and by pilgrims returning from Rome) into Ireland, this special character of decoration was there developed in an extraordinary manner, with the utmost ingenuity, and by artists whose subtle sense of beauty brought the art to wonderful excellence especially in golden chalices and ornaments, and in illuminations.

Of some of these, in the "Book of Kells," one of the greatest treasures in Trinity

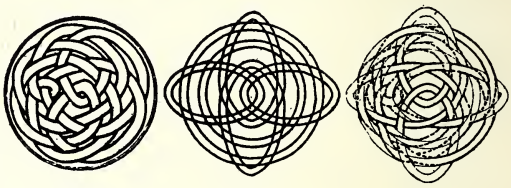


FIG. 5. FIG. 6. FIG. 7.

College, Dublin, Mr. J. O. Westwood says: I have counted in a space scarce ⅜ of an inch in length by less than ½ an inch wide, no fewer than 158 interlacements of a slender ribbon pattern, formed of white lines edged with black ones. The invention and skill far surpasses all found in ancient manuscripts by continental artists.

Everything is pressed into the service of this decorative work, even eight human figures, of which the thirty-two limbs form the interlaced work filling the panel to be decorated; but there was evidently some underlying and never failing principle forming the basis of every pattern, however intricate, which had not been grasped even by those most devoted to Celtic art.

To take as an example one of the most beautiful specimens extant of the "endless-ribbon pattern" in a panel on the Cross of Tuam (Fig. 1).

This is composed of one or more ribbons without ends, interlaced so as always to cross under and over alternately. If, beginning in any corner or any spot, the pattern is traced with a pencil, it will arrive back at the starting point, the whole of the ribbon having been marked; and it will be found that, while the latter seemed during the tracing to wander in apparently, the most reckless and aimless way about the surface, it had really arranged itself into an intelligible and orderly pattern devoid of repetition, but containing a general harmony throughout—one knot or twist balanced by a corresponding though totally different one; while all through the bands cross one another alternately under and over, without a single break.

To explain the process in a few words.

The artist first covers the space to be decorated with lines crossing one another, and woven in and out like basket-work. Fig. 2 gives the plain basket-work that formed the foundation of the pattern on the Tuam Cross (see Fig. 1). He then proceeds to join all the ends two and two together. In Fig. 3 is shown by dotted lines the manner in which this is done. Finally, the artist obliterates crossings here and there, joining the ends thereby set free in a manner differing from that which they originally followed. A glance at Fig. 4 will make this process clear. It will be seen that it is a tracing from Fig. 3 except that the crossings obliterated in the completed design are shown by faint lines, while the subsequent joinings are shown by dotted lines. If this be now compared with Fig. 1, it will be seen that the design is the same, and that we have easily and exactly followed the method by which the artist, between one and two thousand years ago, turned the simple basket-work of Fig. 2 into the elaborate and beautiful decoration on the Tuam Cross. Every knot, every winding is there, and it is all one ribbon.

The Tuam Cross pattern was intended to fill a square or oblong, and the foundation of it was, as we have seen (Fig. 2), composed entirely of straight lines. But this special kind of decoration is also well adapted for circular spaces. We give a specimen of the work, drawn by Mr. Trench to illustrate the paper read by him on the subject (Fig. 5).

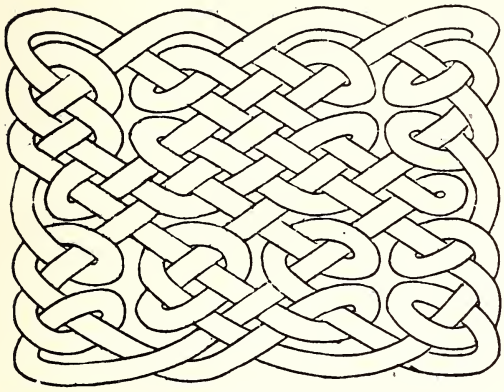


FIG. 1.

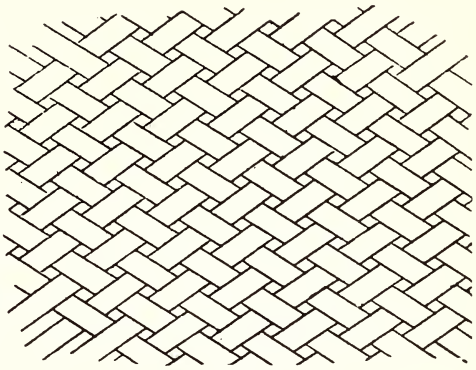


FIG. 2.

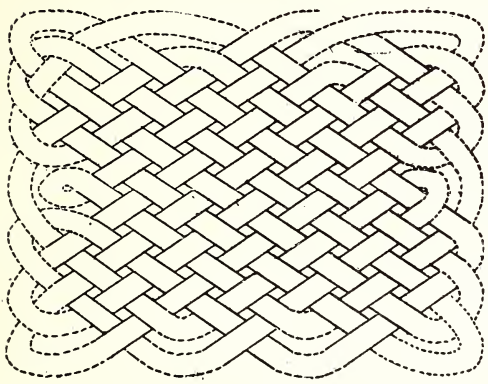


FIG. 3.

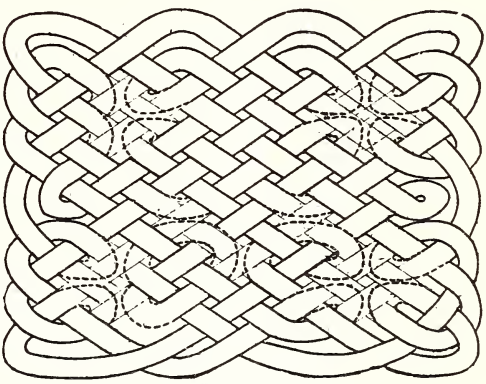


FIG. 4.

In the foundation for this pattern there is not a single straight line. It consists of two concentric circles and four ovals (Fig. 6).

It is notable that while in the completed oblong pattern (Fig. 1) the greater part of the original foundation remains, it is so much obliterated in the circular pattern that it is not easy to perceive the process by which Fig. 5 has grown out of Fig. 6. It will, however, be seen at once by a glance at Fig. 7, where as before in Fig. 4, the portions of the foundation obliterated are shown by faint lines, and the subsequent joinings by dotted lines.

If the faint lines be entirely erased the exact pattern of Fig. 5 remains.

Yet, as Mr. Trench remarks, "anyone can join the ends, anyone can obliterate crossings, but the excellence of the patterns consists in the skill with which these processes are carried out, and herein lies the art." The excellence attained in the incomparable ancient specimens remaining of this art do indeed show skill, as well as something far higher.

It is possible that some possessing this rare gift may use the discovery which has been made to produce decoration as lovely and as varied as that of old; but for this a master's hand is needed, and the instinct of poetic genius. No knowledge of the rules of metre in poetry, or skill in using them, would have given "Rose Aylmer" or "Auld Robin Gray" to the world.—The Architect and Contract Reporter.

CROSSES—THEIR DESIGN AND MEANING.

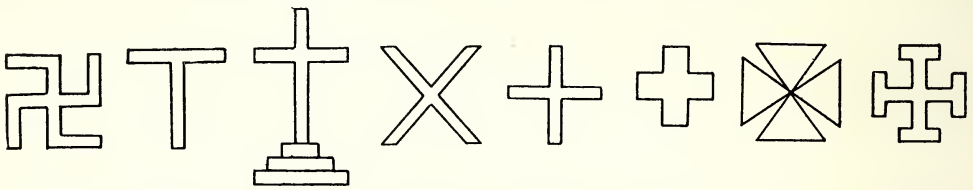


FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6. FIG. 7. FIG. 8.

There is no symbol more generally in use among designers of monumental sculpture than the cross. It is claimed for it, that it was known to all peoples and in all lands, centuries before the crucifixion of Jesus of Nazareth made it the symbol of Christianity. And if we accept the Swastika as a form of the cross (as many assert it to be), this claim must be allowed. The Swastika (Fig. 1) is, in fact, the earliest known symbol of any kind. It consists of a cross with arms of equal length and width, bent at right angles. It was used everywhere as a sign of good augury and benediction. It seems to be not generally known that it has been adopted as a Christian symbol, and it is not generally used as such. But to the present writer it appears that it might be accepted as a sculptural design, signifying in secular work, good augury; and, in a religious connection, benediction.

What is knows as the Tau or St. Anthony's Cross (Fig. 2) is likewise more ancient than Christianity, having been used in Egypt under the name of canob (from the god Canopus), and as the symbol of the future life. It is not a form of cross that lends itself readily to a decorative purpose.

The Crux commissa, or Latin cross (Fig. 3), is the most generally accepted Christian symbol, and the other forms of crosses are probably derived from it by the same natural process by which all decorative motives are envolved from some simple ancient form of decoration. Properly formed, the transverse beam of the Latin cross is one-third the length of the upright portion from the top, and its arms are of equal length with the upright above them. If the cross be intended to stand upright, its pedestal should be made in the form of steps, and is then known technically as a Calvary.

The Crux decussata (Fig. 4), is of the form of the letter X. It is known more generally as the St. Andrew's cross (sometimes as St. Patrick's), and in heraldry as Saltier. It is the national emblem of Scotland.

The four arms of the Crux immissa (Fig. 5), or Greek cross, are of equal length. When each arm is composed of a perfect quadrilateral, it is called the St. George's cross (Fig. 6). St. George of Cappadocia is the recognized saint of England. A cross of this form refers to the four quarters of the earth to which Christianity was sent by means of the four Evangelists and their four Gospels.

The Maltese cross (Fig. 7), the badge of the Knights of Malta, is composed of four spear-heads meeting at their points; and the eight points thereof are intended to symbolize the eight beatitudes.

These forms of the cross have many variations in heraldry. The cross of Jerusalem (Fig 8) is composed of four Tau crosses joined at their bases, and is known in heraldry as the cross Potent. The Latin Crosslet (Fig. 9) is a beautiful form

of cross for use as a decorative motive. There is a Greek crosslet (Fig. 10) likewise. The terms "Bottony, Pommee and Fouchee," applied in heraldry to crosses, refer to the ornamentation upon the arms of the cross. And this suggests an important point for the consideration of those who have occasion to use the cross as a Christian symbol. The fleur-de-lys, or other floration or foliation of the arms of the cross, signifies the Cross Glorified —as the cross was when He who was crucified thereon rose from the dead. Hence, it is the proper symbol of the Church whose central doctrine is the Resurrection and not the Crucifixion, and it would seem to be the proper form for use in monumental art rather than the more severe form of the Latin or Greek cross.

The cross is sometimes doubled (Fig. 11) and tripled, (Fig. 12). The double form is called in heraldry Patriarchal. It is the symbol of office of Archbishops and Cardinals. The triple cross is the symbol of the Papacy.

The Greek letter Chi is often made in form of a cross in its combination with the Greek letter Rho; and the sacred monogram thus formed of the first two letters of Christos is sometimes (though improperly) called the Cross of Constantine (Fig. 13).

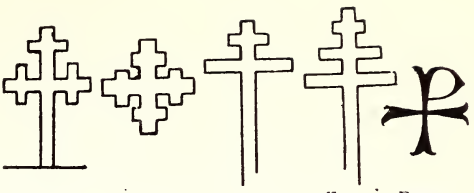


Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13.

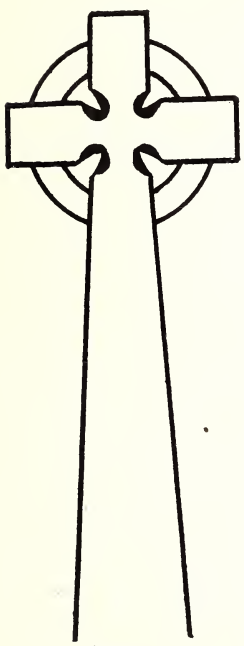


Fig. 14.

The intersection of the arms of the cross are often enclosed within a circle. The circle represents Eternity. When the cross is made to occupy a prominent place upon a shield, the shield becomes the symbol of the Shield of Faith.

In the adoption of the upright Latin cross for monumental purposes, a difficulty arises which it is impossible to overcome. If the monument be not actually unenduring, it will have that appearance however permanent the material may be in fact. This gives to the recumbent cross the great advantage, besides its furnishing a richer field for artistic treatment.

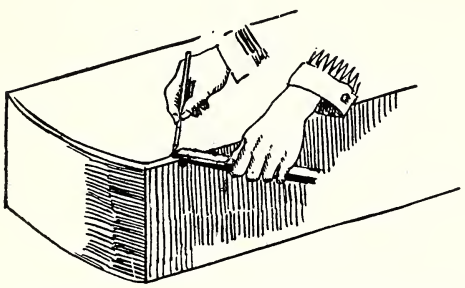
A form of cross which, for monumental purpose, has come into great popularity of recent years is that called the Celtic. It is probably derived from the Oransay Cross, said to have been erected by St. Columbia in one of the isles of western Scotland in the sixth century. It is still standing. These Celtic crosses have short arms in proportion to the height and the circle (Fig. 14). They have the appearance of frailty, though they are cut in very durable granite. They are further characterized by exquisite interlaced ribbon carving thereon. To design one of these Celtic, Runic or Ionian interlaced figures, or even to copy the design of another, is no easy matter. But the effect is most gratifying when accomplished.

L. Viajero

DRAFTING AND DESIGNING SECTION

EASY WAY TO DRAW BORDER LINES ON DIES.

A line to be drawn on a die, marker, etc., for a border or margin, also for different kinds of tracing, when straight parellel lines are required, can be much easier accomplished and more accurately, also more speedily drawn by using a small chisel held under the rule, by the hand, which also holds both chisel and rule against the side of the stone, than by measuring with a rule for every line and then using a straight edge to draw the lines. A rule with a chisel held as illustrated can be



DRAWING BORDER LINES ON DIE.

used on all straight surfaces and on round planes. No other way is there so accurate to draw a line on top of an oval top die or marker with any success as by using this method. Always hold the chisel tightly against the rule, at the same time with the same hand hold the chisel against the stone. With the other hand hold a pencil or scratcher if working on marble. By practice one can save time and worry using this system.

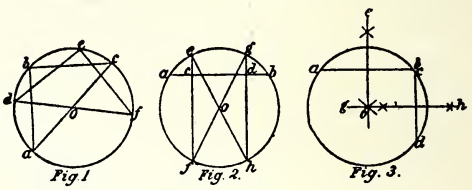
* * *

HOW TO FIND THE CENTER OF A CIRCLE.

Very often it is necessary in the drawing room or shop to find the center of a circle, a disk or a piece of shafting, etc., when the diameter is not given. Below are three ways in which this can be done:

The first, Fig. 1, is the method usually used. It consists of two right triangles drawn so that their angles are in the circumference of the circle as a, b, c, and d, e, f. The point where their hypotenuses intersect is the center of the circle.

The second method is shown in Fig. 2. Draw any chord as a, b, and take two



HOW TO FIND THE CENTER OF A CIRCLE.

points on it as c, d, equidistant from its ends. At these two points erect perpendiculars to a, b, cutting the circle at e, f, g and h. Then draw e, h, and f, g, and the point where they intersect will be the center of the circle.

Fig. 3 is similar to Fig. 2. Draw any two chords as a, b, and c, d, and at their centers erect perpendiculars to them. The point where the perpendiculars meet will be the center of the circle.

* * *

HANDLING DRAWINGS ON THIN PAPER.

"In pasting designs on paper other than heavy cardboard, I find it is impossible to make a neat job; wrinkles will show and the paper will have a tendency to warp. I have used both the white paste and mucilage. Will you please enlighten me on this subject? Is it the paste or mucilage I am using or do I apply it incorrectly?—J. C., O."

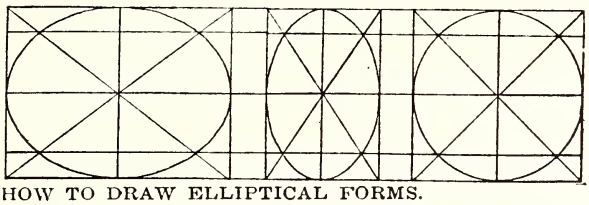
It does not make much difference what kind of paste one uses, but library paste is generally preferred. To stick thin paper one must prepare the edges by turning them up on the four sides and folding at least one-half inch in. Then put the paste on these turned-up edges; next dampen the paper over the surface very evenly. Should it be a drawing that the water will spoil, dampen it on the back side. Be careful that the water does not touch the turned-up edges that hold the paste. Place the paper in the required place and weight it down with some large books; do not remove the books until the paper is dry.

Another way is to use paste over different parts of the paper and place it on the proper place also placing books on it so that the paper will stay straight until dry. Wrinkles will not appear if this is done correctly and carefully. J. W.

* * *

DRAWING ELLIPSES AND OVALS.

A very practical ellipse for monumental draftsmen is one that is constructed from a square. First draw a square, then draw a circle in it which touches at four sides. Next draw the center division lines each way, then the two transversal lines from the corners. At a point where these transversal lines touch the circle is the point used for the construction of the ellipse. All the perpendicular lines are drawn below the square and a rectangle formed. The center lines and transversal lines are found again in this rectangle and from these points the ellipse is drawn freehand from point to point. This is the best way to draw an ellipse for the stone shop, because you can draw one to any given measurement. If one was to be drawn one foot long and six inches wide, you would only have to construct the square one foot in measurement and the rectangle below it six inches high. This would make the exact measurement wanted. Should you want the ellipse to be eight inches in height, the same plan would be used, except the lower rectangle would be first drawn eight inches high. Very long forms can be drawn only by drawing the rectangle two or four inches high. This same system is used to draw an upright ellipse. The illustration shows this. The same square is used and the rectangle is made the required length. This last form is often required to be drawn on the face of a monument sometimes very large. One will find when having one to draw that if he will make the square and rectangle on a large piece of paper first, then trace or make a pattern, that it will be much better than trying to sketch it direct on the stone freehand.

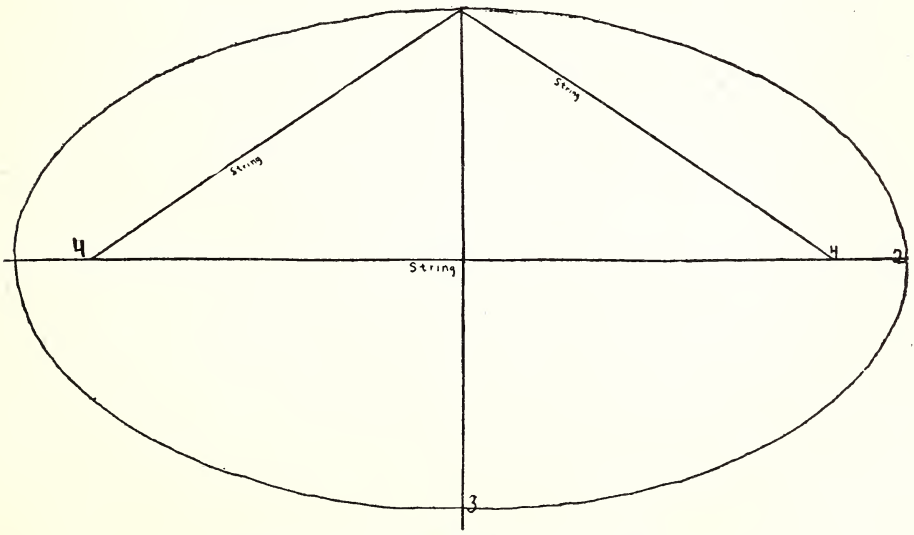


HOW TO DRAW ELLIPTICAL FORMS.

S. M., Mo.

* * *

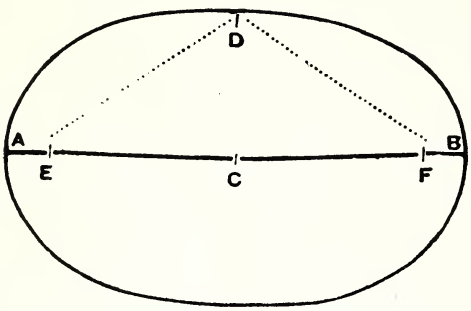
I have a way of drawing an ellipse that does away with all off-hand lines. The accompanying diagram shows how it operates: The diagonal and horizontal lines represent strings. Get the center line both ways and place dividers at point No. 1; get No. 3 and get points Nos. 4 and 4; set dividers at points Nos. 4 and 4 and



METHOD OF DRAWING AN ELLIPSE.

draw a string, point No. 5, and tie it; place pencil in string and draw the ellipse as this was done. This rule works on any length or breadth desired.

A method for getting a perfect oval devised by L. Walkup, is as follows: "Draw a vertical line the desired length of oval, mark ends A and B. Bisect and mark point C. From C draw a horizontal line half of desired width of oval, designate end of this line D. Now measure from this point D a distance equal to one-half the length of oval (or the distance from A to C) back to the vertical line between A and C and mark with a dot E. Do likewise from D to line between C and B and make a dot F. Drive pins in these dots E and F. If working on marble or other material where the pins may not be driven in, put a drop of hot sealing wax on the place where t' pin is to be stuck. The wax will secure the pin for making the oval and can be removed without damage to the stone. Tie a thread designated by dotted lines, with a



DRAWING AN OVAL

small loop at each end, the exact length of the oval, place a loop over each pin, stretch the string with a pencil point and, keeping it tight on both pins, draw from A to D to B. This forms half the oval; repeat for other side."

* * *

In the course of our practical experience in monumental work it is often necessary to lay out an oval or ellipse, and it frequently happens that the best method is not ready to mind or accessible otherwise. But it is always advisable to retain such necessary information in the memory or filed away for immediate reference. The several given herewith will be found accurate in results and simple in method of procedure:

Figure 1.—Draw the horizontal line A B, the length of the oval or ellipse is to be made. Divide the line A B into two equal

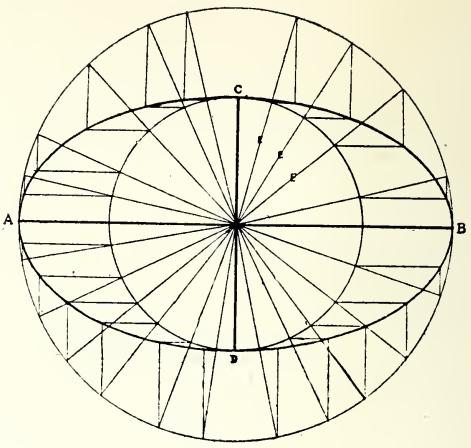


FIGURE 1.

parts with a vertical line C-D. Make this line the length that is desired for the thickness of the ellipse. With the point of intersection of the lines A-B and C-D as a center strike a circle just touching the points A and B. With the same center strike a circle touching at points C and D. From the center of these circles strike radii, three of which are marked E. The more of these radii drawn the easier to get a correct ellipse. Draw these radii to the outer circle. Where the radii touch the outer circle draw vertical lines in toward the line A-B (not parallel to it.) Where the radii cross the inner circle draw horizontal lines out from the circle until they meet the vertical lines from the outer circle. Where the vertical and horizontal lines meet we get the points for the oval or ellipse. Connect these points free hand and you have the ellipse or oval.

Fig. 2.—Draw the horizontal line A-B the length the ellipse is to be made. Divide the line A-B at the center with the vertical line C-D, making this line the length that is desired for the width of the

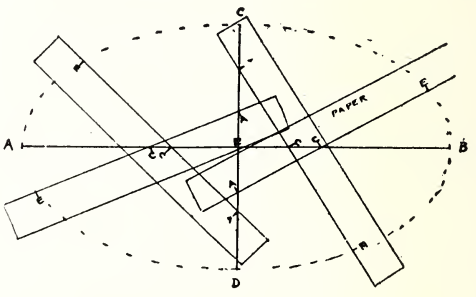


FIGURE 2.

ellipse, having it divided at the center by the line A-B. Where the lines A-B and C-D cross mark E. Take a strip of paper and put the point A on it. From A mark off to the right the distance A-E and make E. From E mark off to the left the distance E-C or E-D and mark C. Place the paper onto the horizontal and vertical lines A-B and C-D, so that the point A on the paper will just touch the line C-D and the point C on the paper just touching the line A-B. Where the point E strikes is one point in the ellipse. Revolve the paper around always keeping the point A on the line C-D and the point C on the line A-B. Where E comes will be a point in the ellipse. The diagram shows the paper placed on in four positions. This method is very easy and saves making many lines. E. S. SAMPSON.

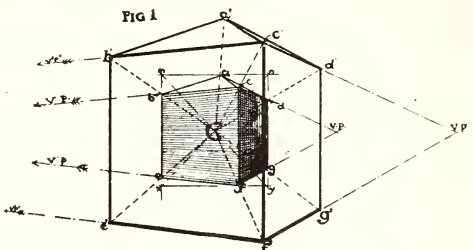
* * *

SIMPLE METHOD OF ENLARGMENT.

The fully equipped draughting room is invariably supplied with one or more of the enlarging devices which may be bought at various prices from dealers in drawing instruments. These devices serve their purpose with varying success according to their own merits and the skill of the operator. It is in such places as these instruments are to be found that they are least necessary, since the draughtsman in charge is presumably capable of rendering an enlargement without their aid, and frequently does so, which is an argument in favor of the method here explained.

The retail dealer whose business does not warrant the employment of a skilled draughtsman frequently has occasion to enlarge a picture of a monument, either a photo or a reproduction, which he has clipped from MONUMENTAL NEWS. His customer was favorably impressed with the small picture and only required to see the same on a large scale,—with Mr. Customer's name shown thereon, mayhap,—in order to become a buyer. This may be easily accomplishd as follows:

Referring to Fig. 1 which represents a die and is chosen for the first example because of its simplicity: a-b-c-d-e-f-g represents the small picture of the die which it is required to enlarge. First arrange the paper on which the finished drawing is to be made, tacking it down to the drawing board. Cut out the picture in the outline of a rectangle which will just contain it, i. e., along the lines m-n-y-x, next draw the diagonals m-y and n-x which will determine the center C. Now affix the small picture to the board on top of the sheet for the finished drawing, so that their centers coincide, and so that any of the vertical lines,—as c-f,—are vertical when tested with T-square and triangle. Now drive a pin firmly into the board at the center point C (a black headed steel pin will make a smaller hole in the paper), and draw the radiating lines C-a, C-b, C-c, C-d, etc. Let us assume that the enlargement is to be two times the size of the original as in the case of Fig. 1. Having drawn all the radi-



CUBE, ENLARGED TO TWICE THE ORIGINAL.

ating lines through the principal points of intersection or corners of the stone, measure the distance accurately from the central point of C to a, and then extend the line that distance further to a′ which is the apex of the die in our enlargement, just as a is the apex of the small original.

The point c′ may be found in the same way, viz.: measure the distance C-c and extend the line C-c its own length to c′. As soon as the points are determined connect them with straight lines a′-c′, and as soon as point b′ is located it should be connected with both points a′ and c′. This method will establish any or all points in the picture and when properly connected, an enlargement is secured which is absolutely correct.

The enlarged drawing may be tested for accuracy by comparing the similar lines of the two drawings. For example, b′-c′ should be exactly twice the length of b-c and parallel to it; so with e-f and e′-f′. For still further accuracy the vanishing points may be determined, or at least one of them as V. P. and V′ P′. The method of finding these points is the same as has been described for finding the other points, it being assumed that the reader is cognizant of the nature and uses of the vanishing point. If he is not, let him either ignore the matter or inform himself by any good book on perspective, which may be obtained from the book shops of the larger cities.

Referring to Fig. 2 we have a stone, or rather two stones, base and die, of quite different proportions, and yet the result is as accurate and direct as in the case of Fig. 1. It will be found by close examination that the point C in Fig. 2 is not exactly in the center of the rectangle a-b-c-d, nor is it essential that it should be, except that the novice will find it easier to observe the rule of centering this point until he is thoroughly familiar with the method, after which it may be taken at random, though preferably, near the center as above described.

Short cuts will suggest themselves to the draughtsman, viz.: Fig. 2. Having established point e′, f′ may be determined by drawing a line through e′ parallel through to the line e-f until it meets the line C-f′ in f′. So through the point e′ draw e′-g′ parallel to e-g and so on with the various lines in the picture.

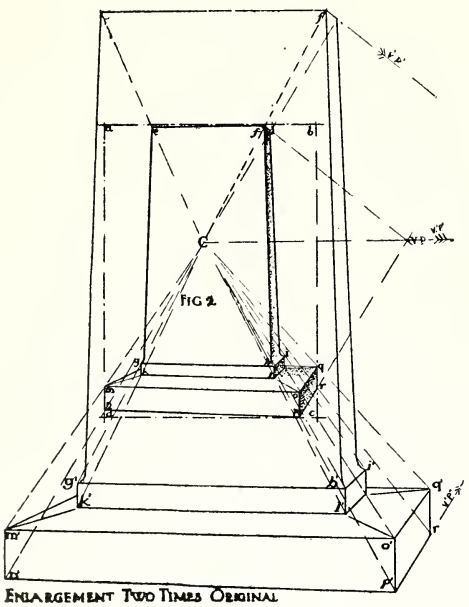
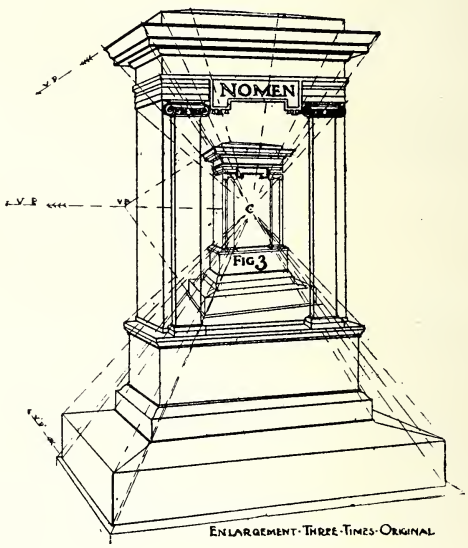


Figure 3 illustrates the same principle applied to a Classic memorial and enlarged three times its original size. The method being the same except that the various lines are extended three times their original length instead of twice as in the Figures 1 and 2. In enlarging such a design as Fig. 3 it is wise to block out such details as the capitals of the pilasters and merely determine the large dimensions of them, working the detail out free-hand.

If it be undesirable to cut a picture down as described it may be tacked down on the board and a very transparent tracing paper used over it, upon which the enlargement may be made and when finished it may be either transferred to a sheet of heavier paper or mounted upon cardboard and inked in. The stencil paper used by air brush designers is apt to be too opaque for convenience unless the small drawing happens to be in black and white, i. e., not half-tone.

It should be noted that enlargements may be made in this manner to any size either



one and a fraction times the original or many times, or with equal facility the drawing may be reduced in size by decreasing the length of the radiating lines proportionately.

The only instruments necessary for doing the work described are such as are to be found in nearly every monument shop,—a T-square triangle, (preferably of celluloid), a foot rule or scale, a drawing-board and a sharp pencil. A proportional divider is a great help, especially when making fractional enlargements though not essential.

This principle is based upon the geometrical theorem that, two triangles, having an angle of one equal to an angle of the other, and their homogeneous sides in proportion, are similar—which is, of course, easily demonstrated by one familiar with geometry.

In the case of curved lines, the enlargement is made by taking points in these lines and connecting the established points in the enlargement. ROBERT L. COOK.

QUICK WAY OF FIGURING ODD SCALES.

Often the necessity arises for figuring up a design to another scale than the one by which it is laid out; to find what dimensions of parts correspond to a given change of total height or base, or vice-versa. Most draftsmen and estimators keep an assortment of the usual scales on hand, but when none of these will apply, a special scale must be made. The ordinary method of doing this is by successive stepping off with dividers, until the desired result is found. This is not difficult when one is working with integral numbers, but it is otherwise when fractional parts are involved. Thus, if a certain line represents ten feet, it is simple to reduce this to five feet, by doubling the scale; for instance, calling a half-inch scale, inch scale. But to reduce from 10 feet to 9.3″ means stepping the original line 37 times, for one must take the 3″, or quarter foot, as the unit.

The method here explained is not new, nor is it familiar to many who may find it of advantage.

The principle is that of geometrically "similar" triangles, which are always proportional.

For example, the shaft of an obelisk design measures 2.9″ at the bottom, on the elevation drawing to 1.½″ scale; it is required to find a new scale which will make the shaft 2.6″.

First draw a horizontal line, A B, Fig. 1, on which tick off, from the 1.½″ scale, 2.9″. (It is usually better to include the full 12″ divisions, so as to have the complete scale of units and 12ths if entire accuracy is desired, though for practical purposes the 3″, 6″ and 9″ divisions are enough, the intermediate numbers being put in by eye. The inch divisions may be at either end, but I prefer them as shown.)

Through A draw A C, at any angle. Tick off on the edge of a strip of paper, 2″.9″ by the scale (the whole distance, without sub-divisions), and transfer to A. C. This gives the point X.

Now draw from Y (which is 2.6 on the old scale) a straight line to X (which becomes 2.6 on the new scale), and through 1, 0, and the subdivisions of 0-12, parallel lines to X Y.

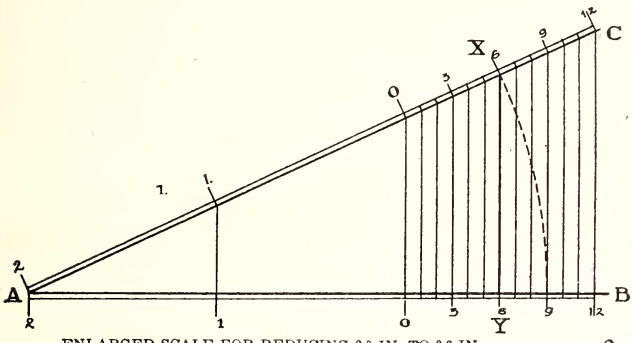
The intersections of these lines with A. C. O. give corresponding divisions, and the required new scale.

The parallelism of the other lines with X. Y.—which is absolutely essential, may be secured by a parallel ruler, or by sliding the hypothenuse edge of a triangle along a T-square or other straight edge, properly placed.

For the reverse operation, to make a reduced scale for the enlargement of 2.2″ to 2.10″, take A X = 2.2″, A Y = 2.10″ join X Y and proceed as before.

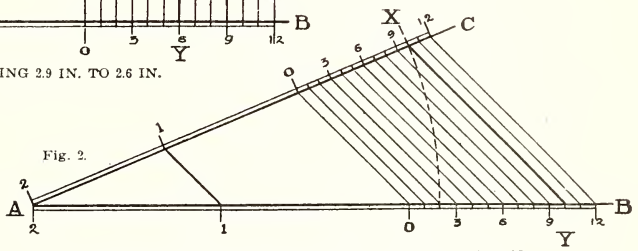
Other applications of the principle will readily suggest themselves, and may be worked out by substituting the desired dimensions in these formulæ.

C. B. Canfield.



ENLARGED SCALE FOR REDUCING 2.9 IN. TO 2.6 IN.

Fig. 2.



REDUCED SCALE FOR ENLARGING 2.2 IN. TO 2.10 IN.

Fig. 31.

Fig. 32

MASONIC LODGE EMBLEMS.

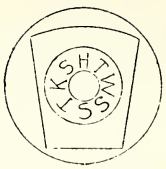


Fig. 33.

ROYAL ARCH MASONIC EMBLEMS.

Emblems of different lodges which are constantly demanded by customers to be cut on monuments are quite difficult to draw, but with the proper drafting they should not be much trouble to execute on stone. The Masonic emblem, Fig. 31, with the compass and square, is very simple and is generally cut in a circle. To draw this commence by making the circle the required size, then sketch lightly the compass; sketch the square next, and by several light strokes of the pencil it will then be in fairly good form. After the center line has been correctly drawn measure the distance of the ends of the compass so each measure the same distance from the center. The bottom of the square should not be as far down as the compass ends. This is at an angle of 45 degrees and must be drawn so that ends will be at half the distance of the length of the compass. The letter G is drawn last. An emblem of this order, which is required to be out of the ordinary in design, is drawn like Fig. 32.

Royal Arch Masons' emblems are drawn like Fig. 33; first draw the circle, then the keystone, lastly adding the lettering. One that requires decoration is drawn the same. The keystone first, the letters next, then the decoration.

The Knights Templar emblems in Fig. 35 are among the most difficult to draw for the reason that there is so much detail in their construction. The proper drafting is of great importance and one will discover if he does not familiarize himself with the entire emblem and practice drawing it many times that it will be so difficult when the occasion arises to put it on stone, that the attempt will be crude and primitive. It will, of course, show up even more poorly when executed by a cutter who has less knowledge of its construction, even than the man who draws it.

It is a fact that in many monumental plants when an emblem is needed there is a hunt for a picture of the one desired; when discovered it is given to the draftsman to copy in pencil with the idea that "it will pass; just so long as it is accepted by a customer it is good enough." Such sentiments as these are detrimental to any one's business and to monumental art.

The first one illustrated is managed by drawing a rectangle. Then each corner is separated and drawn in the direction of the rectangle's center. Next the cross and crown is lightly sketched in, getting the proper proportions of each. The top piece is drawn last. When all the necessary lines have been sketched proceed to draw, with a clean-cut, sharp line throughout, correctly. The letters are drawn last.

The crown should be drawn by using two parallel curved lines in forming the top and bottom; then the two ends forming a rectangle. The length is horizontal. When this is accomplished the detail is easily drawn by placing dots for each ball and a line for the bottom of each curve.

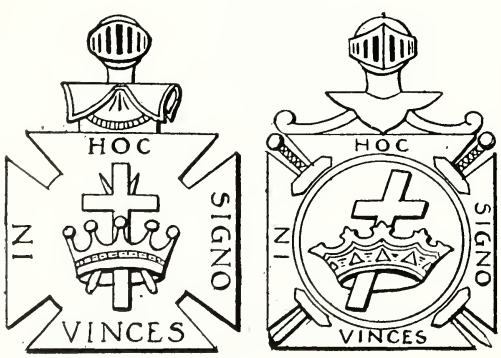
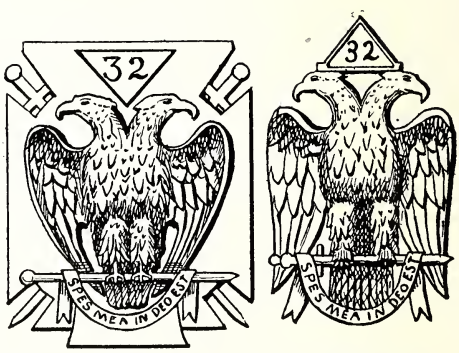


FIG. 35. KNIGHT'S TEMPLAR EMBLEMS.



No. 1. No. 2.

FIG. 36. CONSISTORY, 32D DEGREE EMBLEMS.

One should have no trouble with top as the contour is a circle with an ellipse drawn upon it. No. 2 is more complicated but is drawn the same in the beginning as No. 1. The cross is on a slant and there are also daggers inserted at the two top corners going under the cross and crown and coming out at the two lower corners. The detail of the top is also a little different from No. 1 but this is all drawn last, after the rectangle has been drawn.

The Consistory 32nd Degree emblem, Fig. 36, No. 1, is a figure built on a rectangular form. The eagle with two heads and one body is quite a difficult drawing.

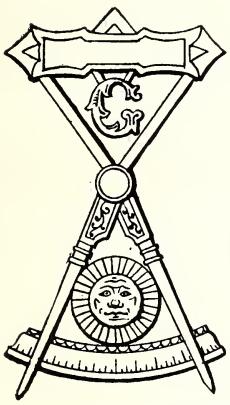


FIG. 37. PAST MASTER'S EMBLEM.

FIG. 38. PAST GRAND HIGH PRIEST'S EMBLEM

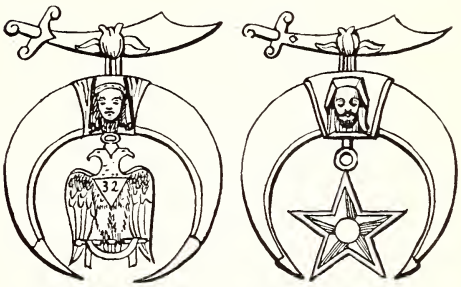


FIG. 39. ANCIENT ARABIC ORDER OF NOBLES, MYSTIC SHRINE.

Do not become confused in trying to draw both sides alike by free hand. First make a good outline of one side from a center line and then use thin tracing paper, covering the side drawn and making the lines as you see them through the paper. Lift this up and turn the tracing paper over and draw the lines as you see them through the paper. This reverses the drawing. This first side drawn is placed on the paper and by using a hard lead pencil for a stylus mark all lines correctly, pressing hard to insure a good impression. The tracing paper is then removed—the impression is made more definite by marking over the lines with a sharp pointed pencil completing the eagle. The small triangle form with the figure 32, and the sword and ribbon are drawn last.

All should be sketched before making a finished drawing of any one part. Another form of this order is No. 2. The rectangle is here discarded and the eagles are drawn larger. No. 1 is best for tracing and No. 2 is the simplest to carve. The Past Master's emblem, Fig. 37, consists of a long rectangle. One side can be drawn first and tracing paper used as explained above for the other side. It consists of a plate with the letter G attached; below is the compass and rule; also the head and circle with its details.

The Past Grand High Priest's emblem, Fig. 38, is also drawn in rectangle. This is a very difficult drawing for the reason that the human figure is represented, which is hardest of all to draw. The figure and eagle with out-stretched wings and the shield with the decoration at the bottom is a small rectangle built on the circle below. Do not try to draw the leaves in the wreath until two lines have been drawn forming the two sides. The leaves are then kept in place. These leaves are in clusters and after you have one cluster drawn tracing paper can be used to draw the others. There is no need for reversing the paper for all are the same.

The urn on the right side is also difficult to draw but by drawing a center line, then sketching in lightly the outline of one side and tracing the other side it is easily drawn. The two drawings, Fig. 39, of the Ancient Arabic Order of Nobles, Mystic Shrine, are of the same construction. Their difference lies in the detail only.

The emblem most used in the Eastern Star Lodge, Fig. 40, No. 1, is constructed on a circle, which is drawn first. Then draw the five-pointed star inside of this circle. Find the exact place for each point by using a compass, dividing the circle into five parts. Then draw from point to point measured on the circle. The inside forms a geometrical figure into which is a rostrum upon which an open book is drawn. All five parts of the star have a different unit

which must be carefully drawn. Another form, No. 2, is a large G with the five-pointed star attached by each point with the same detail except that a compass and square displace the rostrum and book. The letter G is drawn first and the inside forms the circle for the star. The detail in the star is then carefully drawn to complete the emblem.

The Past Grand Patron emblem, Fig. 41, is built up from a rectangle. After the head piece has been slightly sketched the five-pointed star is drawn. Then the small border around it. The inside of the star is quite complicated and the geometrical figure touches the inside of the beginning of each point and the compass and square are drawn within. Inside of each sectional point are drawn the same figures as in Fig. 40, No. 1. The Past Matron emblem, Fig. 42, is drawn the same as Fig. 41 except in some of the detail. The figure inside has a mallet and at the in-

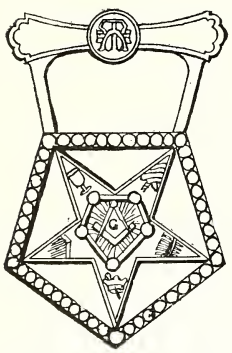


FIG. 41. PAST GRAND PATRON.

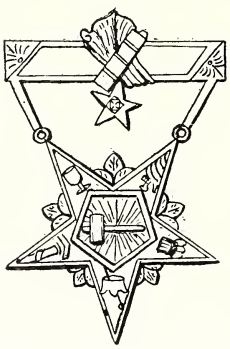


FIG. 42. PAST MATRON'S EMBLEM.

tersection of each point are drawn leaves. These should not be difficult after drawing them several times. Each time one is drawn there will be seen some mistake in your former practice until you can draw an emblem correctly.

Emblems as a rule are very difficult to draw, when one tries to execute them directly on stone, because the lines are hard to correct. Always draw them correctly on paper, for they must be sketched lightly to get them into shape and proportion before any definite lines are used. No draftsman can draw any complicated subject correctly without first lightly sketching in the big masses. The Independent Order of Odd Fellows' emblem, Fig. 43, should not be difficult to draw. It is a simple object, but if it is not started correctly difficulties will be met with. When beginning to draw this it must be looked at as a square rectangle and when sketching this rectangle which you must do, be sure you get the right proportion with the four straight lines needed to get the top, bottom and sides. These are the most important of any of the lines you will use. When the correct shape of the rectangle

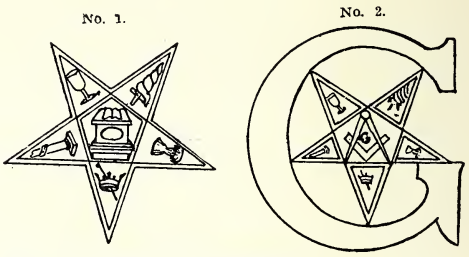
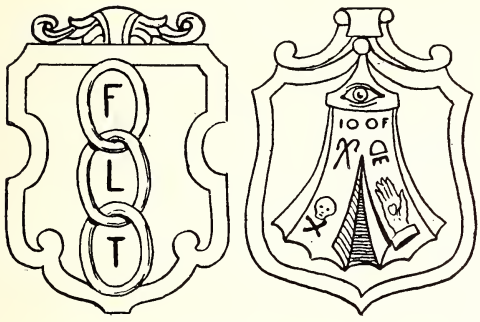


FIG. 40. EASTERN STAR EMBLEMS.

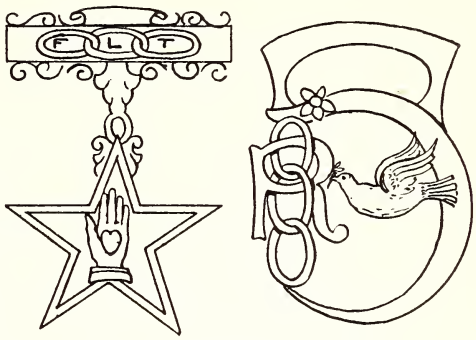
has been drawn proceed by finding the center and draw a line perpendicularly from the top to the bottom. Then lightly sketch at the out side of the form all the curves and straight lines needed to get a correct outline. With a sharp pencil point draw out these lines for the finished drafting. The other side must be drawn to correspond with the first side. This is accomplished by using tracing paper as has already been explained. The three links are not difficult to draw but they must be started right or you will have trouble. Begin by finding the center of the rectangle and then draw the middle link, then connect the top and the bottom one to it. Fig. 43, No. 2, is another form of an emblem used for the same lodge and, as No. 1, after drawing the rectangular form, the tent and the detail will follow. The tent is in perspective and must be so drawn so as to look as if it had the third dimension. By making the folds smaller as they recede it gives the appearance of being round, not flat. Perspective will be fully explained later on. The Past Grand emblem of the Independent Order of Odd Fellows, Fig. 44, No. 1, would be a simple drawing if it were not for the hand. The small rectangle at the top must be sketched, then the circle for the star. Do not at once use a compass to draw the circle but sketch a circle free hand so you can tell what proportion you want. The star must be lightly sketched, also the hand before any finishing lines are drawn. After the rectangle and the star have been finished correctly you will have great difficulty with the hand. A good hand is nearly as hard to draw as a head and can not be drawn anywhere near correctly until one has some knowledge of the bones and muscles, also

of the planes. By holding your own hand for a model one can be drawn successfully. Fig. 44, No. 2, Rebekah Degree Independent Order Odd Fellows is quite complicated and must first be very carefully sketched in. Each part must be the right proportion and if it is not they will not hold their place in the drawing. Three links are used to represent the perpendicular bar for the larger "D" and the "R" is drawn over and under these links. To draw the bird do not start at the head, completing it, then the body, lastly adding the wings. But draw a line from the head through to the end of the tail, two lines for the breast and bottom of the tail, also two lines for the wings, one vertical and one nearly horizontal. These lines will represent the direction and size of the different surfaces. The head is then drawn, then the detail of each wing outside and inside. All lines representing feathers are drawn last. Fig. 45, No. 1, the Mason and Odd Fellow emblem combined, is simple. The explanation of the square and compass has already been given. No. 2, Fig. 45, is a uniform rank Knights of Pythias emblem. It is very easily drawn but full of detail. Like the other emblems the detail is not important until the last. In the drafting, one side of this should be drawn first and the other transferred. No. 1, Fig. 46, is another emblem of the same order and the only difference is the detail. The open book must be drawn open, showing top and two sides, it cannot be drawn showing top and bottom alike, except as a straight line for each. The reason for this is one can see both sides of an open book, for the leaves form a slanting line enabling the eye to include both sides. If they were square like the bottom and top they would also be drawn as a straight line, showing no thickness unless a view was taken of it from one side. Then that side would show thickness while the other side would still be a straight line. No. 2, Fig. 46, Past Chancellor, Knights of Pythias emblem, is very hard to draw and will require a great deal of study to do so. The outside form has the essential lines for the beginning. The head and shoulders of the man in armour are then sketched, then the eagle, lastly the smaller detail. To draw the eagle, think of the long lines in a mass, not the smaller ones only, until all large lines have been drawn representing fully the size and proportion of the outside. This eagle is in a crouching position, having the appearance of going to fly at once. The fierceness of an eagle



No 1. No 2.

FIG 43; INDEPENDENT ORDER OF ODD FELLOWS.



No 1. No. 2.

FIG. 44; REBEKAH DEGREE, INDEPENDENT ORDER OF ODD FELLOWS.

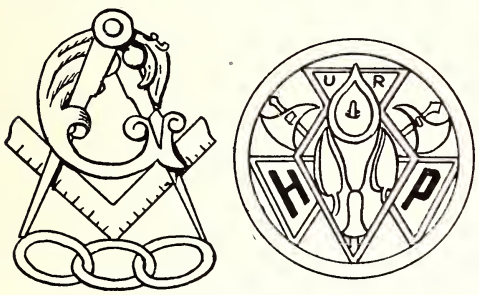


FIG. 45.

No. 1., Masonic and I. O. O. F. No. 2. Uniform Rank, K. of P.

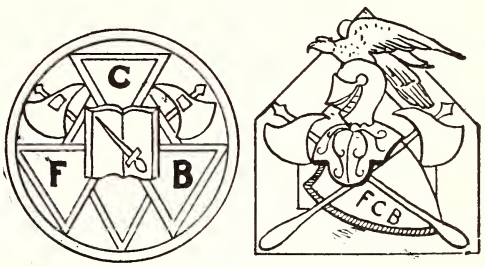


FIG. 46.

No. 1., Knights of Pythias. No. 2., Past Chancellor, K. of P.

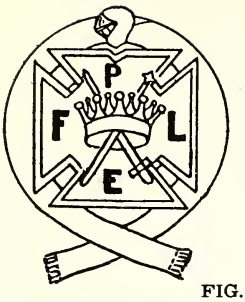


FIG. 47.
No. 1. Pythian Sisters. No. 2. Knights of Maccabees.

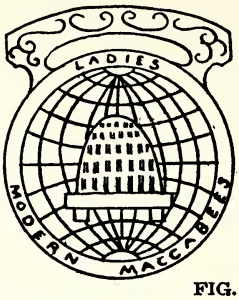


FIG. 48.
No. 1; Ladies of Modern Maccabees. No. 2; Ladies of Maccabees.

head is made by drawing the bill large and with a decided crook. Also make the eyes large, with the brows long and low down. Fig. 47, No. 1, Pythian Sisters' Auxiliary to Knight of Pythias emblem, is a square in a circle for the first sketch. The corners of the square are then drawn, and lastly the crown and other smaller detail. The bottom of the crown which gives appearance as being round is a circle in perspective drawn as an ellipse. No. 2, Fig. 47, is a Knights of the Maccabees emblem. The only difficult part is the hand and to use your hand as a model as instructed before will be difficult. You can not get your left hand in the position wanted. Therefore you must use your right hand held in front of a mirror, and the hand you see in the mirror will be reversed giving the proper position. One will have to look at the hand and then use your pencil drawing from memory.

Fig. 48, No. 1, Ladies of Modern Maccabees' emblem, is a simple drawing and should be drawn without any instructions.

No. 2, shown in Fig. 48, is the Ladies of Maccabees' emblem, and is composed of some very difficult drawing. The bird has not the same action as the one at Fig. 41, but the instructions as to long lines and large masses must not be overlooked. The clasped hands are the most difficult of any detail of an emblem illustrated. One cannot clasp his own hands in a position wanted, therefore you must resort to copying them line for line from another drawing, or have two people pose with clasped hands and draw from them. This is the better way, and, in fact, to draw any naturalistic object it is always best to draw from the object itself than copy other people's lines.

The official design of the Woodmen of the World, as adopted by the Sovereign Camp, is the stump with the Latin term below the same, as shown in the accompanying illustration.

The design required to be placed upon the monuments of this order is the total showing in the picture circling the stump. This is placed upon the face of all Woodmen of the World monuments in accordance with Section 70 of the Constitution and Laws of the Order, adopted May, 1907. The "V" sunk circles and letters between must be cut not less than one-eighth of an inch deep and the stump raised not less than three-eighths of an inch. The circle must not be less than eight inches in diameter.

OFFICIAL EMBLEM FOR WOODMEN OF THE WORLD MONUMENTS.

* * *

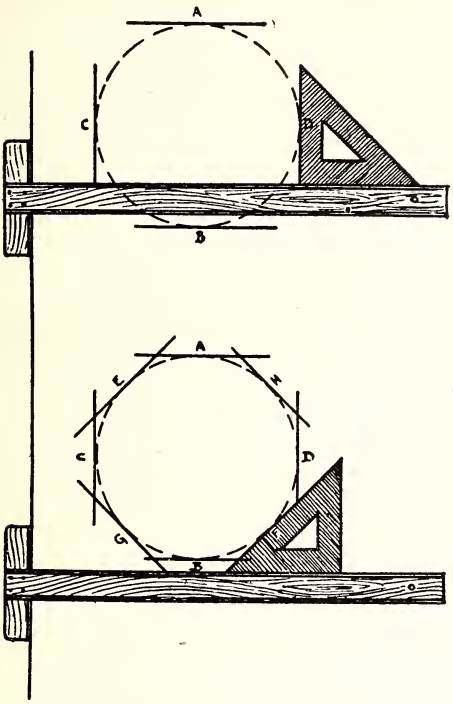
DRAWING AN OCTAGON OR HEXAGON.

Often in drawing out the details of some monument or other piece of granite work it is necessary to make a plan of an octagon or hexagon. To do this by the usual geometrical method is time wasted.

In the case of an octagon the simplest plan is to describe a circle of the same diameter as the desired octagon and with the T-square set off lines A and B at a tangent to the circle. With the 45° triangle set off lines C and D. These form

four sides of the octagon and it is now only necessary to reverse the triangle and, using the T-square as a guide, lay down the lines E, F, G and H, also tangential to the circle. The octagon is then complete.

A hexagon may be drawn in a similar manner with the 60° triangle, but in this



DRAWING AN OCTAGON OR HEXAGON.

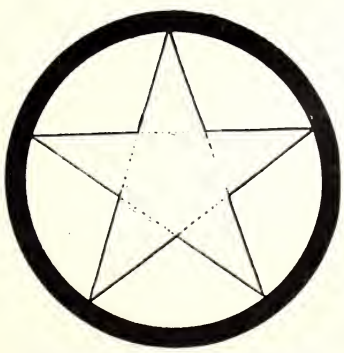
case it is only necessary to set out lines A and B before using the triangle.

A. S. Hill.

* * *

DRAWING A FIVE-POINTED STAR.

To properly draw a five-pointed star first draw with a compass a circle the required measurement. Then draw a perpendicular line through the center. Find equal distances for five points, beginning at the top center. Draw a line from the top center to the lower right point, then to the lower left point. Next, a line horizontally to the upper points at each side and connect them with the lower right and the lower left. This is a form often used in the monumental business and often very poorly drawn. W. C

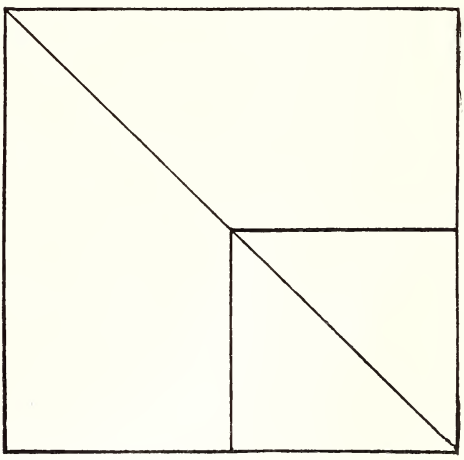


DRAWING FIVE POINTED STAR.

* * *

FINDING A 45 DEGREE ANGLE.

If one has a 45 degree angle to be cut on a joint of a stone or lines for decoration, a quicker way to measure is with the rule rather than with a mitre square, because every time one has to draw a line the square has to be reset, and then it is



HOW TO MEASURE TO GET A 45 DEGREE ANGLE.

rarely at exactly the proper place. By the method of rule measurement the exact mitre is found. Supposing the stone coping is 4 inches wide, all one has to do is to measure 4 inches back from the end; then draw a line from the end corner to the measurement on the other side of the stone. This gives a true 45 degree angle. If a stone is very wide one can make two measurements about 6 feet or 1 foot, as illustrated, and connect the corners; then by running a line from the outside corner to this point, making the line continuous, it will be the right angle at any given place.

SIMPLE PERSPECTIVE IN MONUMENTAL DRAWING.

As the old receipt has it, "To cook a hare, first catch your hare," and to draw a monument you must first have in your mind the shape the work is to take. In this first case we will make use of one already built, and standing in the yard, so that we can see how much our picture will look like the original. We first measure it, and get the sketch shown in Fig. 1.

This will be recognized as a type of monument very generally selected, and so I

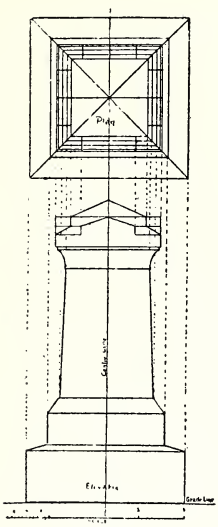


Fig. 2

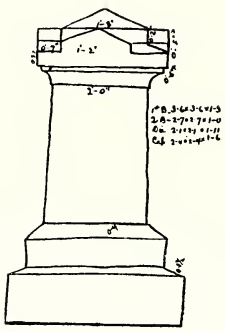


Fig. 1

suppose it will be as good as any to start with, and not too full of detail to be confusing. To draw anything to scale, we must know what relation in size the original thing and drawing are to bear to each other, and the first thing to decide is the scale you wish to use. This you will find to be one and one-half or two inches to the foot in actual practice, but in this case we will draw it to the scale of one inch to the foot, which will be still further reduced to allow the drawing to appear in these pages. To follow out these instructions as an exercise draw the work to a one and one-half or two-inch scale.

As scale drawing bears a fixed relationship of size to the object drawn, the use of the one-inch scale will make all the parts of the drawing one-twelfth of the actual size of the stone. Knowing the measurements of the different parts, we can construct the elevation, which may be called the mould of the monument, needing only to be enlarged in scale to make a full size working drawing for the stone-cutter.

We turn our rule around to the side upon which the one-inch scale is marked, and after drawing a line across the paper at the bottom, which will be the grade-line, and one at right angles to it up and down the board, we begin our measurements. We refer to our memoranda and find the lower base of the proposed drawing to be three feet six inches square, and so we lay off at equal distances on both sides of the center line point 3½ inches from each other. Each stone is laid off in the same way on each side of the center line, and the heights of the same also, until every part of the monument is reduced to the scale. The line drawn through the center divides the monument into two parts, which are exactly alike, and is drawn there in the beginning simply for convenience in arranging the stones concentrically. As this monument is square in plan there is no necessity of drawing more than one side, as they are all alike.

This elevation with its accompanying plan, as shown in Fig. 2, is used in the construction of the perspective, and it would be well to make elevations and plans for practice before trying for the perspective. Ordinarily the elevation is drawn first and the plan follows, but there are times in the designing of monuments when a plan is the first consideration. But this plan is more in the nature of a perspective diagram, and it is taken directly from the elevation by running perpendiculars with the T square.

We will now take up the perspective.

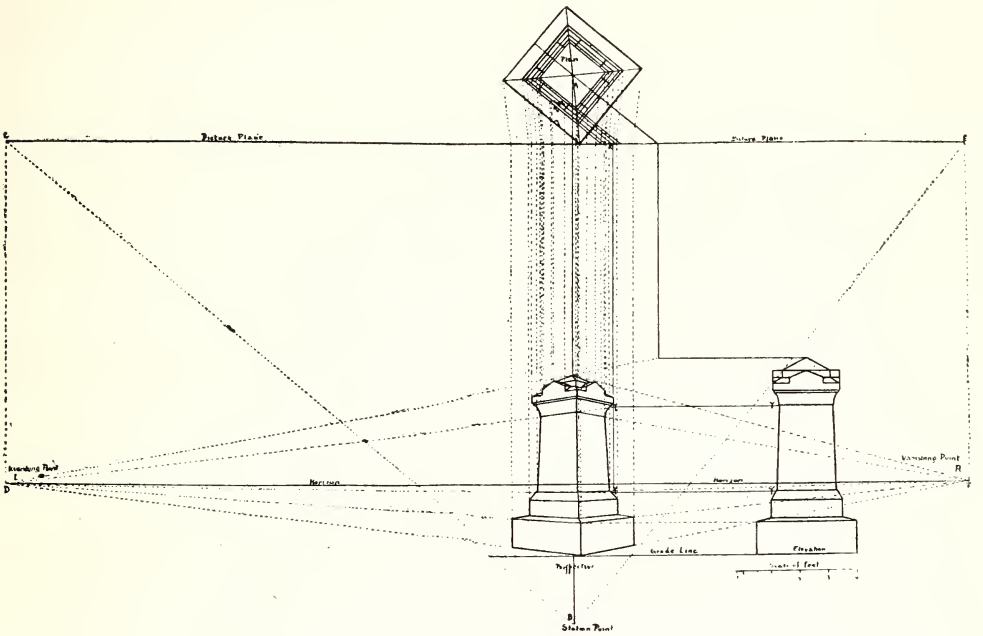
The plate shown as Fig. 3 illustrates with as few lines as possible the arrangement of plan and elevation described with a view to making perspective.

The plan is first drawn on a separate piece of paper and fixed to the top of the board by drawing pins, at an angle, which represents the point of view. In practice, a little more of the front than of the side is usually shown, although it would simplify things to make both front and side equal. With the plan in the position indicated in the plate, draw a line across the board touching the extreme point of the plan. This line is the "picture plane."

Now the distance the spectator stands from the stone is to be determined on, and in this case, for the sake of space, it is about 17 feet, although from 30 to 50 feet would be better when you come to copy this. If the line A B is drawn at right angles to the picture plane from the cen-

ter of the plan, and 17 feet measured on it, in the same scale as the elevation, the point B will be known as the "station point," and will represent the position from which the monument is viewed. This point can be any distance desired from the picture plane. A pin should be driven in here. The paper

With these points all arranged the drawing of the perspective begins. The first thing to be done is to draw lines from the extremes of all the stones in the plan in the direction of the station point until they meet the picture plane. This puts all the parts of the monument in the same



on which the perspective is to be drawn can be tacked down anywhere between the station point and the picture plane, over the line A B. For convenience the elevation can be fixed on the board at the right of this paper, and the line drawn directly from it. The horizon is now to be drawn. It should first be marked on the elevation and then continued indefinitely across the board. This line is supposed to be the level of the eye, and is to be fixed accordingly, though in this case it is only two feet and seven inches above the grade line. It is best to make the horizon low in this way, as it makes the monument appear to stand on an elevation. About three feet is a good height for ordinary cases. All these measurements, be it understood, are taken in the scale of the elevation. And now we are at liberty to fix the vanishing points. From the station point to the picture plane draw the lines B C and B E parallel to the sides of the plan. Where these lines meet the picture plane the lines C D and E F are dropped to the horizon, and at the ends of these lines pins are driven. The points D and F are vanishing points. All horizontal lines in the perspective meet at one or the other of these points.

plane. (It is a common but bad practice to run the lines directly from the plan.) From where these lines meet the picture plane, perpendicular lines let down determine all the vertical lines and points of the drawing. The first line drawn would be one from the corner of the first base where it touches the picture plane. Dropping this down to the grade line you would get the corner of the first base nearest the eye, and a place to begin the construction of the drawing. From where this line meets the grade, lines are run off to the vanishing points in either direction, and you have the lower lines of the base in perspective. The sides of this base are defined by other perpendiculars dropped from the proper points on the picture plane.

Referring to the drawing there should be no trouble after this in getting the vertical lines. The next difficulty is learning to measure the heights, and with this mastered everything is clear. Any stone can be put in its proper position in the drawing in the following manner: The side line of the stone in the plan is extended until it touches the picture plane. From this point a line is dropped to the grade line. This is the line of heights for this stone.

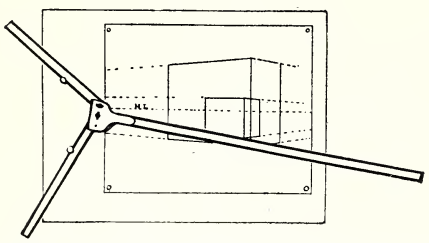
Suppose it is the die we are getting. The side line of the die in the plan is extended to the picture plane at X. From X a perpendicular is dropped to the grade line with the T square, the upper and lower lines of the die are projected across from the elevation until they meet the line of heights at Y Y; from these points they run to the vanishing point, and with the vertical lines from above will give one side of the stone. The other way to the vanishing point gives the other side.

Notice how the height of the monument is arrived at and try the method on a larger piece of paper.

* * *

THE PERSPECTIVE SQUARE.

The illustration given here shows the use of the perspective square. It is used instead of the long straight edge when the vanishing points are off the board. The simplest way is to make a small drawing of the top and bottom lines and find the vanishing point on the board. Then for the



USING THE PERSPECTIVE SQUARE.

large drawing the perspective square is useful as the radius lines are found; two tacks are used, one for each prong at the left to the square. These prongs are movable. By moving them and placing the tacks against them in different places the proper places are found for them. The square shows in the illustration only for the left side. The prongs are at the top and center. But for the right side they must be changed. The one that is at the top now should be taken off and changed to the bottom, which will be the top for the right side.

* * *

I have never found a perspective square worth its price, as there are simpler and as practical ways of avoiding the use of a long straight edge in perspective drawing, to reach a vanishing point that is off of the drawing board.

First: A long, strong thread tied at one end to a tack on the vanishing point can be used to give the location of the different radii on the edge of the paper, and from the points so found a short, straight edge can be used to draw the actual lines. This is a very practical way.

Second: With the vanishing point as a center, draw the arc of a circle on the outer edge of the drawing board and use an ordinary short T square from this arc to obtain the perspective lines. The ruling edge of the T square should be in the center of the T instead of off center, as they are usually constructed. This is easily accomplished by cutting off one end of the T. With one so constructed, if the outer angles of the T are both coincident with the arc of circle, the straight line obtained will be the same as if drawn directly from the vanishing point.

Third: If preferred, the arc can be cut out of thin cardboard or wood and tacked to the drawing board at the proper place, and the T square then used against it as a guide, in the same way it is used against the straight end of a drawing table. Since the T square will move against a circle instead of in a straight line, the result will be radii diverging from the vanishing point instead of parallel lines. Sets of these arcs in wood can be purchased from art stores.

ALEX. DOYLE.

* * *

MASKING TRACING FOR AIR-BRUSH WORK.

Editor Asked and Answered: In the use of the air brush in masking granite designs, a paper mask is cut out to cover background. How can I mask fine tracing which must show white on polished surface? The difficulty is that fine lines, one-sixteenth of an inch or less, if cut in paper, will not lie flat, but will warp and get out of place. If you can put the trade wise on this point you will save a lot of profanity. —S. G. F., Neb.

There are various methods of covering narrow strips. In most cases stencil paper is used. This is a stiff paper, almost as heavy as cardboard, and in order to keep it close to the drawing, so that the color will not spread under it, small pins, known as stencil pins, can be used. These are sold by various dealers at 15 cents per dozen and in lots of four dozen for 50 cents. Other operators use metal or sheet celluloid for the same purpose. The latter is often used when the mask is wanted in the form of a curve or an angle.

THAYER & CHANDLER.

In putting a very delicate paper mask on the background, we have found the use of common white shellac a satisfactory material with which to hold such a mask in place. After completing the brush work, the mask can be lifted up and the shellac crumbles and brushes off when dry without any tendency to adhere to the paper However, we note that your subscriber mentions a fine line one-sixteenth of an inch or less to indicate a white traced line on a dark polished surface. One way to accomplish the same result is to make a white ink line instead of using any mask at all. Another way, and probably the more common way, is to use Ross scratchboard paper and scratch the lines in. This is only possible, of course, on scratchboard paper, but this paper is commonly used in connection with work of this character. BLISS DESIGN CO.

* * *

SIMPLE WORKSHOP DRAWINGS.

Many shop men begin simple drawings with the detail first, which is like putting the cart before the horse. These few drawings are some that are used quite often in most workshops and a great deal of time is lost because the draftsman does not know the principles of a foundation of preliminary lines.

* * *

DRAWING MASONIC EMBLEM.

The first is the Masonic emblem. This design is drawn in many different ways, good and bad. Here illustrated is a simple, practical system.

The height is first determined, which is 3 inches, the width is 3½ inches. This proportion will be suitable at all times. Just as soon as these measurements have been determined center lines each way are drawn. Next the top circle is drawn and from the outside width, lines are drawn to each of the lower corners, then from the inside of the top circle two other lines are drawn until they connect at the lower bottom ones. Lines for square are started at the lower center of the rectangle to a line a little above the center horizontal line. Then by measuring the width the square will be at both ends; then draw the lines to them and the rough emblem is drafted. The ends of the square are sometimes finished at right angles and in other ways this is drawn after the two side lines have been fixed. The small circle representing a screw is drawn, using a small compass; the inside of the compass is then drawn and the letter G last.

ODD FELLOWS' EMBLEM.

The Odd Fellows' emblem is a very simple drawing to execute if it is started in the proper manner. Many workmen have a great deal of trouble because they try to make first the lines that should be drawn last. Fig. 2 shows just how the preliminary lines should be drawn. First draw with a compass the size curve desired and

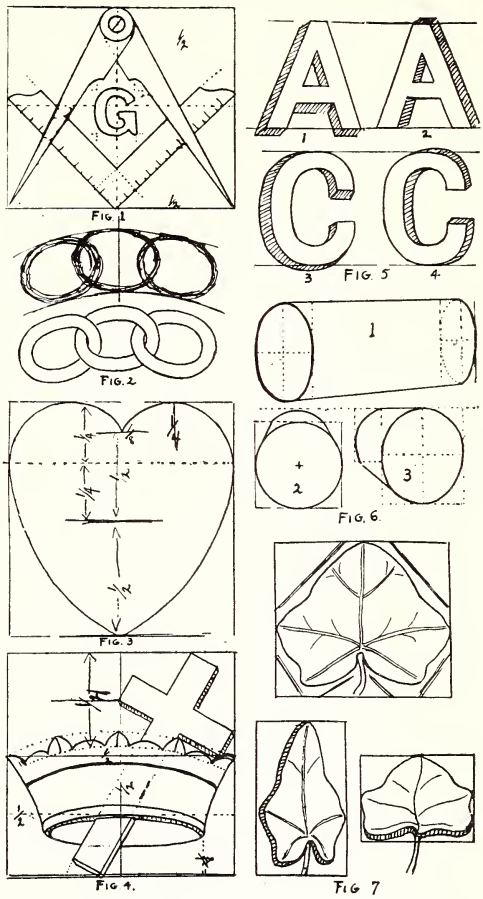


Fig. 1.—Drawing the Masonic Emblem. Fig. 2.—The Odd Fellows' Emblem. Fig. 3.—How to Lay Out a Heart. Fig. 4.—How to Draw the Cross and Crown. Fig. 5.—Ways of Shading Letters. Fig. 6.—Drawing Rolls in Perspective. Fig. 7.—How to Draw the Ivy Leaf.

the right width of two parallel lines. Then the first or center ellipse is drawn in rough sketchy lines, and on each side of the center the other two are sketched. Preliminary lines like these give size and form. Not until after these sketchy lines have been used does the draftsman begin to draw with correct lines. To draw the correct lines one only has to follow the outside of the preparatory lines. The center one is drawn first an equal distance on each side of a center line. The one on the right side is drawn next the same width as the center one. The last one at the left is drawn, using the same measurement and lines as the others.

TO DRAW A HEART.

The heart often used for monumental purposes is drawn very mechanically and different sizes and proportions are drawn on the same system. First draw a rectangle of the proportions wanted; find the perpendicular center of it; now find the horizontal center, next find one-half of the top half. Then find a line at the center which is one-eighth from the center; from the one-eighth line draw the right side to the top line where it intersects with the one-fourth perpendicular line. Continue to draw in a circle until the line touches the outside of the triangle at the one-fourth horizontal line, then continue the line to the center at the bottom. When one side is finished draw on a piece of thin tracing paper over this line then transfer the line to the other side.

* * *

THE CROSS AND CROWN.

The cross and crown is a very hard subject to draw unless one draws it systematically. It can not be drawn correctly any other way. A good system is here shown at Fig. 4. Draw a rectangle and find the center both ways and one-fourth of top and bottom half. The top line of the crown on each side is at the outside center. A curve is first drawn from these points; that represents the top of the crown. The bottom line is situated at the bottom quarter and is drawn similar to the top one. Next the side lines are drawn from the outside top to the bottom, which is at a distance of one-eighth. This completes the first line of the crown. All other lines are then drawn to represent the character of the crown in question. The cross is drawn at different angles but the angle here represented seems to be a good one to use. You can find this by drawing the right side long line from top to bottom; from the top a little to the left of the right top corner of the triangle and extend it to a little to the left of the bottom center. This line being properly situated all other lines of the cross are drawn to correspond, making a correct cross.

* * *

DIFFERENT WAYS OF SHADING LETTERS.

A letter may be shaded so that it will appear to be seen from many different viewpoints. The draftsman needs to be proficient in shading so that the letters will appear to be viewed from the same point as the other parts of the monument. The A at No. 1 is above the eye, also to the right of vision. When a letter is placed in that position the bottom and the sides can be seen as prominent as the face of them. The corner lines of the shading start downward to meet the eye or to a horizon. No. 2 shows just the opposite point of view. This letter is seen to be below the eye, also to the left. The corner lines of the shading extend upward to a horizon and the shading makes the letter have the appearance of being raised and at some place cut on the monument low down, probably on the lower part of a die or on the base, while the letter at No. 1 would be at the top of the die above one's head. In No. 3 the C is in the same position as No. 1, only it is a letter with curves and much harder to shade than one of straight bars. The same principle is used to shade it, though the corners do not meet the surface of the ends of the bars; a straight line but gradually becoming narrower as the curve goes around away from the eye. No. 4 is shaded like No. 2 and curve lines are used like No. 3. A beginner will have trouble in commencing the corners at the right place. Good practice is obtained by drawing from cut letters on a monument.

* * *

DRAWING ROLLS IN PERSPECTIVE.

Without a practical knowledge of perspective the draftsman has trouble in drawing rolls that are viewed from the front and end. The drawing at Fig. 6 shows a practical way to draw one in three different positions. In the first, the point of vision is at the left of the front, therefore one sees the end and the front from one viewpoint. By drawing triangles like the ones here constructed and drawing an ellipse within them one gets the proper curves for the ends. No. 2 shows the viewpoint exactly in front and a little higher than the roll. The front or end is drawn with a compass, a complete circle, the two sides perspect narrower at the top and a part of a true circle is drawn to complete the farther end. One can see by drawing a square rectangle that the top of it is also the line on which the far end of the roll terminates. No. 3 is an opposite view from No. 1, except that one stands more to the end and does not see the length so parallel. The end of this drawing is not drawn with a compass for it ceases to be round when viewed from the side. It now becomes elliptical and is drawn free hand, using a rectangle for guide lines. The lines form-

ing top and bottom of the length perspect very quickly and the far end of the roll terminates as in drawing with the top of the rectangle and at a point just above the left side of the ellipse. When one can successfully draw and understand the principle of these views he should be able to draw other positions correctly.

* * *

THE IVY LEAF.

The ivy leaf, which probably is used more than any other leaf in the monumental business, is often of very bad form. The first thing to do is to draw a rectangle, then cut the corners by lines which serve for the rough form. The curved lines are drawn last. By using different kinds of rectangles one can draw the leaf in different positions in perspective. By using a long rectangle one sees the length but not so square a view of the front so the drawing will show the thickness. There is also another view making the leaf appear as if lying down, using a different kind of a rectangle; different appearances are made by using the rectangle in odd forms.

J. W. WYCKOFF.

ENTASIS AND DIMINUTION OF CLASSIC COLUMNS.

To the cultured eye many of the columns used from the classic orders in modern cemetery memorials are unshapely and unbecoming on account of not having a perfect and gradual diminution. Columns used by the ancients in imitation of trees, from which they derive their origin, were tapered in straight lines, so that the shaft was the frustum of a cone, but, finding this form abrupt and disagreeable, they made use of some curve, which springing from the extremities of the superior and inferior diameters of the column swelled beyond the sides of the cone, and this gave the most pleasing figure to the outline. In the specimens of antiquity the diminution is variously performed; sometimes beginning from the foot of the shaft, at others from one-quarter, or one-third, of its height; the lower part being left perfectly cylindrical. The former of these methods was most in use among the ancients and being the most natural, seems to claim the preference, though the latter has been almost universally practiced by modern architecture, from a supposition, perhaps, of its being more graceful, as it is more marked and strikingly perceptible. Vitruvius in the second chapter of his third book mentions this practice; but in so obscure and cursory a manner, that his meaning has not been clearly understood; and several of the modern architects intending to conform themselves to his doctrine, have made the diameters of their columns greater in the middle than at the foot of the shaft, as shown in Fig. 1.

FIG. 1.

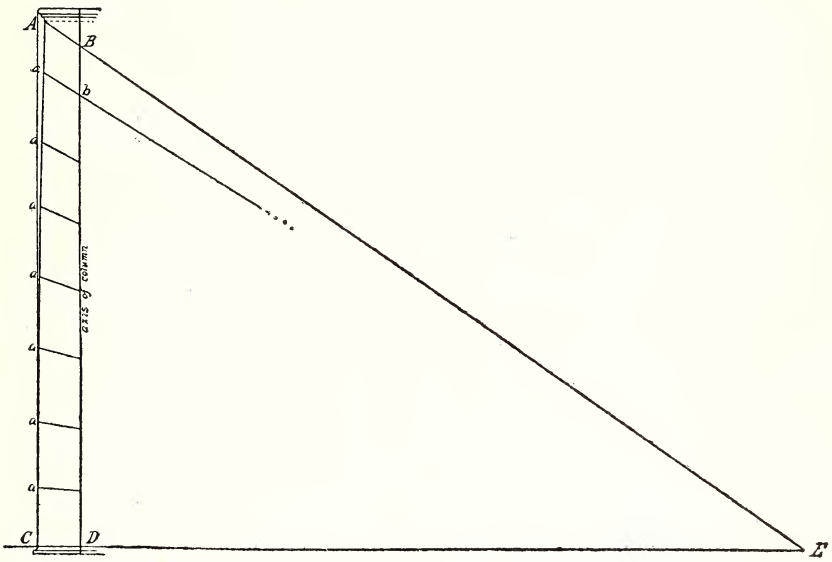


FIG. 2.

Leoni Baptista Alberti with several of

the Florentine and Roman architects, carried this practice to a very absurd excess for which they have been justly blamed, it being neither natural, reasonable, nor beautiful. Alberti divides the height of the column into seven parts, and places the greatest swelling at the height of the third division of these parts from the base; so that he assumes the doctrine of Vitruvius by the strict letter, conceiving his meaning to be that the swelling is very near the middle of the height of the column.

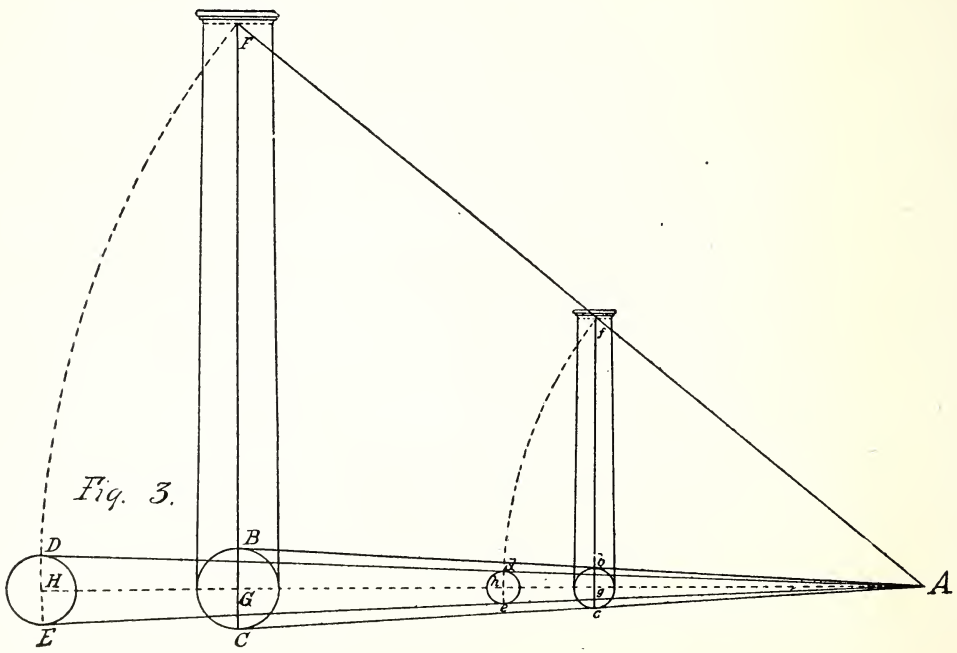
Sir Henry Wotten, in his Elements of Architecture, says, in his usual quaint style, "And here I must take leave to blame a practice grown (I know not how) in certain places too familiar of making pillars swell in the middle, as if they were sicke of some tympany or dropsie, without any authentique pattern or rule to my knowledge, and unseemingly to the very judgment, and sight," and indeed his saying is extremely just and founded on what is observable in the works of antiquity, where there is not a single instance of a column thicker in the middle than at the bottom, though all, or most of them have the swelling hinted at by Vitruvius, all of them being terminated by curves.

The following method of obtaining the true entasis of a column is a discovery of Vignola and, although it is less known than any other it will be easily comprehended by the illustration herein. Having therefore determined the dimensions of your column, Fig. 2 (that is to say the height of the shaft, and its inferior and superior diameters), C and A, draw a line, indefinitely from C through D, at right angles to the axis of the column; this done, set off the distance C D, which is the inferior semi-diameter and from A the extreme point of the superior semi-diameter to B, a point in the axis, the interval C D. Then from A, through B, draw the line A B E which will cut the indefinite line C D at E; and from this point of intersection E, draw through the axis of the column any number of rays as E ba, on each of which, from the axis towards the circumference, setting off the interval C D, you may make any number of points a, a, a, through which, if a curve be drawn, it will describe the swelling and diminution of the column, and produce a most graceful contour.

The columns in the Pantheon, at Rome, accounted the most beautiful among the antiques, are traced in this manner, as appears by the exact measures of one of them to be found in Desgotez's Antiquities of Rome.

In the remains of antiquity the quantity of diminutions at the upper diameter of columns is various; but seldom less than one-eighth of the inferior diameter of the column, nor more than one-sixth of it.

The last of these columns is by Virtruvius, esteemed the most perfect, and Vig-



nola has employed it in four of his orders, as we have in all of them, there being no reason for diminishing the Tuscan column more in proportion to its diameter, than any of the rest; though it is the doctrine of Vitruvius and the practice of Palladio, Vignola, Scamozzi and almost all the modern architects. On the contrary, as Monsieur Perrault justly observes, its diminution ought to be rather less than more, as it actually is in the Trajan column, at Rome, being there only one-ninth of the diameter. For, even where the same proportion is observed through all the orders, the absolute quantity of the diminution in the Tuscan order, supposing the columns of the same height exceed that in the Corinthian is the ratio of ten to seven; and if, according to the common practice, the Tuscan column be less by one-quarter at the top than at its foot, the difference between the diminution in the Tuscan and in the Corinthian columns will be as fifteen to seven; and in the Tuscan and Doric nearly as fifteen to nine; so that not withstanding there is a considerable difference between the lower diameters of a Tuscan and of a Doric column, both being of the same height, yet their diameters at the top will be nearly equal, and, consequently the Tuscan will not, in reality be any stronger than the Doric one; which is contrary to the character of the order.

Vitruvius allots different degrees of diminution to columns of various heights, giving to those of fifteen feet one-sixth of their diameter. to such as are from twenty to thirty feet, one-seventh, and when they are from forty to fifty feet high, one-eighth only; observing that, as the eye is easily deceived in viewing distant objects, which always appear less than they really are, it is necessary to remedy the deception by an increase of the dimensions; otherwise the work will appear ill-constructed and disagreeable to the eye. Most of the modern architects have taught this same doctrine, but Perrault proves the absurdity of this theory which will be herein explained and illustrated. For, if the validity of Perrault's arguments be not assented to and it is required to judge according to the rigor of optical laws, it must be remembered, that the proper point of view for a column of fifty feet high, is not the same as for one of fifteen; but, on the contrary, more distant, in the same proportion as the column is higher; and that, consequently, the apparent relation between the lower and upper diameters of the column will be the same whatever its size.

For if we suppose in Fig. 3, A to be a point of view, whose respective distance from each of the columns f g, F G is equal to the respective heights of each, the triangles f A g, F A G will be similar; and A f, or A h, which is the same, will be to A g, as A F or its equal A H, is to A G: therefore if d e, be in reality to b c, as D E is to B C, it will likewise be apparently so; for the angle d A e will then be to the angle b A c as the angle D A E is to the angle B A C and if the real relations differ, the apparent ones will also differ.

The eye of the spectator is supposed to be in a line perpendicular to the foot of the shaft; but if the columns be proportionately raised to any height above the eye the argument will remain in force, as the point in view must of course be proportionately more distant; and even when columns are placed immediately on the ground which seldom or ever is the case, the alteration occasioned by that situation is too trifling to deserve notice.

Scamozzi who esteems it an essential property of the delicate order to exceed the massy ones in height, has applied the above cited precept of Vitruvius to the different orders; having diminished the Tuscan column one-quarter of its diameter, the Doric one-fifth; the Ionic one-sixth; the Roman or Composite one-seventh; and the Corinthian one-eighth.

In the preceding part of these definitions upon the subject, the fallacy of Vitruvius' ideas has been shown upon principles which cannot be set aside, that is, with respect to the heights of his orders, and where the error of reducing the Tuscan column more than any of the others has been proved, which diminution is explained by the foregoing arguments.

However, it must not be imagined that the same general proportions of the esteemed works of the Romans and Grecians, who, in the opinions of the most eminent writers, carried architecture to the highest degree of perfection, will on all occasions succeed because consideration should always be given to the position of the columns or monument, and to the several altitudes or depressions from which it will be seen where majesty and grandeur of manner should be extended to their utmost limits.

FRANKLIN L. NAYLOR.

THE COMPOSITION AND STRUCTURE OF GRANITE.

Not alone for its strength and durability, does granite occupy the leading position as a structural stone; its variety of tone and texture, and its susceptibility of high polish also give it a wide range of usefulness, while its geological formation and intricate association of the various materials in the composition of its mass, which are named or classified according to the predominating accessory mineral. In the U. S. the biotite, or mica granites are the most abundant.

Solid a material as granite appears to be, it is astonishing what an amount of water it naturally holds. According to one eminent authority, granite ordinarily contains

Table of the principal constituents of the granites of a number of the granite producing states; compression and shearing strains. Based on averages:

STATE	Principal Constituents							Compression lbs. per sq. in.	Shearing lbs. per sq. in.
	Silica per cent	Oxide of Iron per cent	Alumina per cent	Lime per cent	Magnesia per cent	Soda per cent	Potash per cent		
California	75.35	3.94	13.69	2.97	.06	1.14	2.18	21,104	2,419
Connecticut	68.11	2.63	14.28	1.86	.80	6.57	5.46	27,218	.....
Delaware	67.98	4.39	16.14	5.89	.53	4.32	.45	24,913	.....
Georgia	69.92	1.31	16.80	1.93	.44	4.78	5.30	27,018	.....
Idaho	61.47	4.46	23.03	5.59	....	4.09	1.22	.....	.....
Indian Territory	65.30	2.60	19.94	4.50	1.00	2.37	2.00	.....	.....
Maine	73.17	1.87	15.15	.80	.11	2.63	5.17	23,748	2,820
Maryland	73.69	3.60	12.89	3.73	.49	2.81	1.48	.....	.....
Massachusetts	76.49	2.03	13.18	.81	....	4.61	5.03	23,189	2,459
Missouri	69.94	2.48	15.19	1.15	.92	3.95	4.29	20,176	.....
Nevada	58.67	7.56	14.89	5.68	1.79	7.69	2.69	.....	.....
New Hampshire	70.85	2.91	15.76	1.38	.65	5.40	2.78	20,477	.....
New York	63.19	12.46	10.50	6.12	1.44	1.91	4.01	23,200	.....
Oregon	68.50	3.25	17.02	4.00	1.58	3.55	2.10	.....	.....
Pennsylvania	74.84	3.69	18.90	1.64	.92	.....	.....	21,684	.....
South Carolina	71.40	2.78	15.38	1.45	.24	2.75	5.52	.....	.....
Vermont	73.54	1.74	16.08	2.16	.20	3.29	2.47	18,744	.....
Virginia	64.12	2.96	20.91	1.98	.66	4.57	4.82	26,415	.....
Washington	69.08	4.27	14.58	3.66	1.70	.....	.....	14,570	.....
Wisconsin	72.12	3.08	15.01	1.62	.51	2.97	3.90	25,000	.....

makes it of more than ordinary interest.

The table above has been compiled from information given in the last U. S. Geological report, and from which many deductions and comparisons may be made and which may be referred to as a basis for deeper investigation. It is not by any means complete for reasons suggested above, and it is to be hoped that future U. S. Geological reports will contain more information regarding the properties of such of the stone products of the several states as are put upon the market for structural or other purposes.

The essential minerals entering into the composition and structure of granite are quartz and the feldspar group, while the accessory minerals which give character to the stone, are the mica group, hornblende, and several others in far less proportion. Many more minerals, however, are mingled with these essential and accessory components, but they are usually only discoverable by the microscope. The large list of minerals found in granite explains its great variety, both of color, texture and quality.

While ordinarily speaking, the average man recognizes granite only as granite, the enquiring mind will soon learn that there are a number of varieties of granite about 0.8 per cent of water, and that in addition it will absorb about 0.2 per cent more, giving a total of 3.5 gallons of water to the cubic yard. Texture and composition have therefore a most important bearing on the quality of granite for many purposes. A close or fine grained stone is usually considered to be more impervious to moisture than one of coarser structure. This is not, however, in all cases a correct assumption, because in structure the uniformity and packing of the grains in the finer material may cause more pore space than in the coarser stone, wherein the grains are structurally better packed, as it were, and of a more impervious character. A study of the mineralogical and physical nature of granite for particular purposes is therefore certainly suggested by the variety of characteristics pertaining to it.

The color of granite is governed principally by the proportions and kinds of accessory minerals present, and also to a considerable extent by the feldspars. Where muscovite, colorless mica, characterizes the stone, light gray will prevail; while the deep color is imparted by the abundance of black mica. Gradations are caused by the presence of the ferro-magnesian minerals, the tints of the feldspar, and occasionally by the quartz. The feldspars

have much to do also with the shades of red, pink, and green.

The variations in the compression column of the table here given must not be adopted as the criterion of the value of a particular kind of granite for certain purposes, for the reason that the greatest compressive strain yet exerted in any of our known examples does not approach the safety line possible in the figures given.

GEOLOGY AND CHEMISTRY OF MONUMENTAL GRANITES.

Please advise me where I can get geological information and analyses of the different granites.—B. C. C., Ill.

Will you please give chemical analyses of various granites used for monumental purposes?————Gt. Co.

Will you please let me know the testing strength of a cubic inch for the following granites; Quincy; Barre; Salisbury; Montello, Wis.; Waushara Red, Wis.; Wausau Red, Wis.; Pike River, Wis., and St. Cloud, Minn.? If you have not the testing strength of all of these granites, please send me what you have.—H. H., Wis.

Most of the information asked for in the above inquiries has previously been published in MONUMENTAL NEWS, but in order to have it all readily available in one place, we have gathered the rest of the data required and are printing it here in full.

The most practical and understandable geological facts about monumental granites are found in general in a number of bulletine that have been prepared by the United States Geological Survey. The most helpful of these are listed below.

As near as we can learn from various reports of the United States Geological Survey and from a number of state geological surveys, the following are the approximate crushing strengths of some of the leading monumental granites:

	Pounds per square inch
Balfour Pink, Salisbury, N. C	51,990
Montello, Wis.	43,973
Berlin Rhyolite, Berlin, Wis	47,674
Waushara Red, Waushara Co., Wis.	38,063
Pike River Gray, Amberg, Wis	27,887
Wausau, Granite Heights, Wis	27,200
St. Cloud, Gray or Red	28,000
Barre, Vt.	19,957
White Westerly Statuary	39,750
Blue Westerly	31,970
Woodbury	22,460
Neroblu (Formerly Pleasant River)	22,410
Bethel White	34,350
Swenson Gray	30,830
Oglesby, Ga.	31,400
Quincy, Mass.	17,500
Mt. Airy, N. C.	24,469
Adirondack Green	14,734
Winnsboro Blue	26,080

You must understand that these figures are not absolutely reliable, as such tests will vary with the kind of stock used and the conditions under which the tests are made. They are, however, the only figures obtainable on this subject, and you can use them for what they are worth. The figures on the Wisconsin granites were obtained from "Building and Ornamental Stone, Bulletin of the Wisconsin Geological and Natural History Survey, No. 4."

The figures on the St. Cloud granites were obtained from a report on the "Stone Industry for 1912," issued by the United States Geological Survey.

The figures on the Barre granite are from a report on "The Granites of Vermont," issued as "Bulletin 404" of the United States Geological Survey, and other interesting facts and figures are to be found in the reports of George H. Perkins, Vermont State Geologist, 1913 and 1915.

The figures on the Westerly and the Concord granites are from Bulletin 354 of the United States Geological Survey, entitled "The Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island."

Information about Mt. Airy, Balfour Pink and other North Carolina granites are found in "The Building and Ornamental Stones of North Carolina," published as Bulletin No. 2 of the North Carolina Geological Survey.

The figures for the Quincy granite were obtained from Merrill's "Stones for Building and Decoration," published by John Wiley & Sons, New York City.

The Balfour Pink crushing strength figures are from the records of tests made at the United States Arsenal at Watertown, Mass.

Following are the chemical analyses of various monumental granites gleaned from the above-mentioned geological reports:

DARK BARRE.

	Per cent
Silica ($Si O_2$)	69.89
Alumina ($Al_2 O_3$)	15.08

Iron sesquioxide (Fe_2O_3)	1.04
Iron oxide (FE O)	1.46
Magnesia (Mg O)	0.66
Lime (Ca O)	2.07
Soda (Na_2O)	4.73
Potash (K_2O)	4.29
Phosphorus pentoxide (P_2O_5)	Trace
Water uncombined (H_2O at 110°)	0.31
Water combined (H_2O ignition)	0.23
	99.76

WESTERLY.

	Per cent Gray	Red
Silica (SiO_2)	71.64	73.05
Alumina (Al_2O_3)	15.66	14.53
Iron sesquioxide (Fe_2O_3). Iron oxide (Fe O)	2.34	2.96
Manganese oxide (Mn O)	Trace	Trace
Lime (Ca O)	2.70	2.06
Soda (Na_2O)	1.578	1.72
Potash (K_2O)	5.60	5.39
Water (H_2O)	0.482	0.29
	100.00	100.00

QUINCY.

	Per cent
Silica (SiO_2)	73.93
Titanium dioxide (TiO_2)	0.18
Alumina (Al_2O_3)	12.29
Iron sesquioxide (Fe_2O_3)	2.91
Iron oxide (Fe O)	1.55
Manganese oxide (Mn O)	Trace
Magnesia (Mg O)	0.04
Lime (Ca O)	0.31
Soda (Na_2O)	4.66
Potash (K_2O)	4.63
Water above 110° (H_2O)	0.41
	100.91

MT. AIRY.

	Per cent
Silica (SiO_2)	70.70
Alumina (Al_2O_3)	16.50
Iron sesquioxide (Fe_2O_3)	2.34
Magnesia (Mg O)	0.29
Lime (Ca O)	2.96
Soda (Na_2O)	4.56
Potash (K_2O)	2.45
Iron sulphide (FeS_2)	0.09
	99.89

SWENSON GRAY.

	Per cent
Silica (SiO_2)	74.47
Alumina (Al_2O_3)	14.15
Iron sesquioxide (Fe_2O_3)	1.16
Iron oxide (Fe O)	1.21
Magnesia (Mg O)	0 63
Lime (Ca O)	1.70
Soda (Na_2O)	1.97
Potash (K_2O)	4.14
Sulphur (S)	0.27
Carbonic dioxide (CO_2)	0.25
Water, not combined (H_2O)	0.06
Water, combined (H_2O)	0.20
	100.21

BALFOUR PINK.

	Per cent
Silica (SiO_2)	76.06
Titanium oxide (TiO_2)	0.12
Alumina (Al_2O_3)	14.10
Iron sesquioxide (Fe_2O_3)	1.20
Manganese oxide (Mn O)	0.20
Lime (Ca O)	0.36
Magnesia (Mg O)	None
Soda (Na_2O)	2.01
Potash (K_2O)	6.00
Phosphoric anhydride (P_2O_5)	.08
Sulphuric anhydride (SO_3)	.18
Loss on ignition	.12
	100.43

MONTELLO.

	Per cent
Silica (SiO_2)	75.40
Alumina (Al_2O_3)	11.34
Iron sesquioxide (Fe_2O_3)	4.16
Lime (Ca O)	.90
Potash (K_2O)	6.44
Soda (Na_2O)	1.76
	100.00

BERLIN, WIS., RHYOLITE.

	Per cent
Silica (SiO_2)	73.65
Alumina (Al_2O_3)	11.19
Iron sesquioxide (Fe_2O_3)	1.31
Iron oxide (Fe O)	3.25
Lime (Ca O)	2.78
Magnesia (Mg O)	.51
Potash (K_2O)	1.86
Soda (Na_2O)	3.74
Water (H_2O)	.44
	100.00

WAUSHARA RED (WIS.)

	Per cent
Silica (SiO_2)	74.62
Alumina (Al_2O_3)	10.01
Iron sesquioxide (Fe_2O_3)	3.85
Iron oxide (Fe O)	1.72
Lime (Ca O)	2.43
Magnesia (Mg O)	0.33
Potash (K_2O)	3.38
Soda (Na_2O)	3.33
Water (H_2O)	0.24
	99.71

WAUSAU (WIS.)

	Per cent
Silica ($Si O_2$)	76.54
Alumina ($Al_2 O_3$)	13.82
Iron sesquioxide ($Fe_2 O_3$)	1.62
Lime (Ca O)	0.85
Magnesia (Mg O)	0.01
Potash ($K_2 O$)	2.31
Soda ($Na_2 O$)	4.32
Water ($H_2 O$)	0.20
	99.67

BETHEL WHITE.

	Per cent
Silica ($Si O_2$)	77.52
Alumina ($Al_2 O_3$)	16.78
Iron oxide (Fe O)	0.84
Magnesia (Mg O)	.32
Lime (Ca O)	2.56
Soda ($Na_2 O$)	1.21
Potash ($K_2 O$)	0.62
Loss on ignition	0.33
	100.18

ADIRONDACK GREEN.

	Per cent
Silica (SiO_2)	70.75
Oxides of iron $\left\{ \begin{matrix} Fe_2O_3 \\ FeO \end{matrix} \right.$	2.70
Alumina (Al_2O_3)	15.80
Lime (CaO)	2.03
Magnesia (MgO)	1.35
Soda ($Na_2 O$)	3.88
Potash ($K_2 O$)	3.46
Loss at red heat ($H_2 O$)	.35
	100.32

WINNSBORO BLUE.

	Per cent
Silica (SiO_2)	69.37
Iron sesquioxide (Fe_2O_3)	1.80
Alumina (Al_2O_3)	15.80
Potash (K_2O)	5.64
Soda (Na_2O)	4.61
Lime (CaO)	1.84
Magnesia (MgO)	Trace
Manganese oxide (MnO)	Trace
Titanium	Trace
Phosphoric acid	Trace
	99.06

ST. CLOUD RED.

	Per cent.
Silica (SiO_2)	71.17
Alumina (Al_2O_3)	13.30
Iron sesquioxide. $\left\{ Fe_2O_3 \right.$ Iron oxide $\left. FeO \right\}$	3.52
Magnesia (MgO)	.30
Lime (CaO)	1.56
Soda (Na_2O)	3.85
Potash (K_2O)	4.35
Water (H_2O)	.64
Carbon dioxide (CO_2)	.21
Titanium dioxide (TiO_2)	.23
Phosphorus pentoxide (P_2O_5)	.23
	99.34

OGLESBY, GA.

	Per cent.
Silica (SiO_2)	70.38
Alumina (Al_2O_3)	16.47
Iron sesquioxide (Fe_2O_3)	1.17
Lime (CaO)	1.72
Magnesia (MgO)	0.31
Soda (Na_2O)	4.98
Potash (K_2O)	5.62
Ignition	0.31
	100.96

LETTERS AND LETTERING

CEMETERY LETTERING WITH CARBONIC GAS TANK.

Inquiry is often made as too how dealers use air drums in cemetery to run pneumatic tools, such drums as are used in saloons to force beer? We were told that some dealers use them for lettering in cemetery. Kindly inform us how it is done. —J. S., Wis.

Richard A. Swanson of Denver has used the carbonic acid gas tanks very successfully for small jobs of cemetery lettering, and we show here a picture of his outfit in operation.

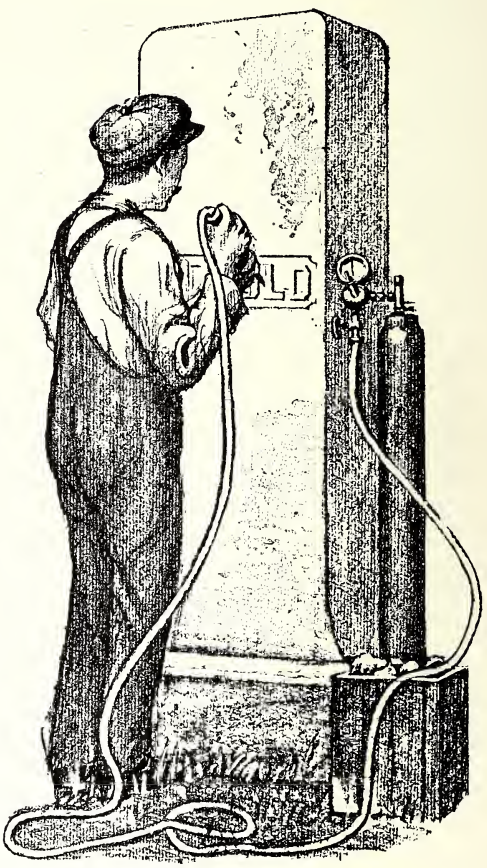
Mr. Swanson gives us a very interesting description of the tank and its operation, which we quote in full, as follows:

"I herewith enclose a photo of the tank containing 'pickled power,' showing it in the act of 'windjamming.'

"These tanks are the same as used to charge soda water or force beer. They are charged with 1,500 pounds pressure when full and can be secured in 20-pound or 50-pound size, viz.: the contents, liquid carbonic acid gas, weighs that much. They can be secured from any company manufacturing carbonic acid gas. Information as to the nearest supply house can be had from druggists running soda fountains.

"A pressure regulator is necessary and is attached next to the tank, as shown. The hose is attached to the lower end of this. Loosen the valve of the regulator as far as possible, then close the valve leading to the hose. Turn on gas at top of tank with key which accompanies the tank, opening it as far as key can be turned, then tighten regulator by turning the key to the right until the gauge shows the amount of pressure desired, usually about 60 pounds, although this can be regulated as required. Attach pneumatic tools, turn on gas by valve at bottom of regulator, and you find 'something doing.'

"These tanks are convenient for cemetery jobs, trimming and lettering, and can be taken in an auto or buggy and handled by one man. They would be too expensive in a shop for continuous use. The tank should be in moderate temperature, but never left in the heat of the sun.



LETTERING IN THE CEMETERY WITH CARBONIC GAS TANK.

"By continuous use they will show frost and even freeze, but a few minutes' 'let-up' will thaw them for a continuance.

"Drums vary in price in different localities; 20 pounds usually cost about $2.50 to $2.60. Drums are returned to manufac-

turers when empty; 20 pounds usually last from 3 to 6 hours.

"As stated before, they are economical on small jobs only, owing to the convenience in transporting them and being handled by one man, besides avoiding fuel expense."

* * *

DIAMOND PENCIL FOR LETTERING.

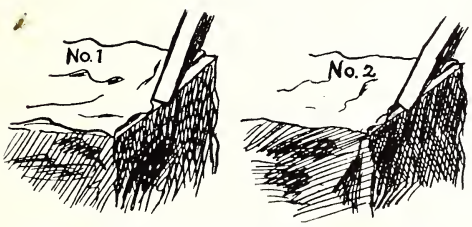
Arthur Berliner, Forest Park, Ill., gives the following information about the use of the diamond pencil: "You can use a diamond pencil five or six years if you use it like a pencil and not like a chisel.

"They not only save a great deal of time, but what is just as important, they make it possible to cut letters sharper and cleaner than can be done otherwise. I have been using the diamond pencils for more than 35 years, and have lettered thousands of inscriptions with them. Apply the whitening and lay out the inscription in the usual manner; then place the straight edge across the top of the letters and lay weights on it to hold the straight edge in place. Then proceed with the diamond pencil to scratch in the vertical and horizontal lines, using the square to insure getting all the lines straight. Hold the pencil with the gold wire side up. The curves in the letters can be cut in with the chisel. Rub off the whitening and the lines of the letters and tracing will be found distinctly cut in the polished face of the stone ready for finishing."

* * *

CUTTING A DRAFT WITH A PNEUMATIC TOOL.

The fault of many workmen when cutting a draft is the lack of preliminary work before the actual cutting, and the holding



RIGHT AND WRONG WAY TO HOLD A CHISEL WHEN CUTTING A DRAFT.

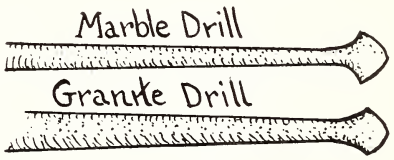
of the chisel in the wrong position. Granite, which is very brittle, must first be chipped very evenly and sharply. This is accomplished by one man holding a straight edge against the granite, with the top edge at the proper place. Another man with hand hammer and sharp chisel chips along the straight edge. The first time over one does not have to be so careful and the chips not so sharp, but a sharp, thin chisel is required to chip the line close and even. When the line is chipped, do not hold your chisel against the granite and cut as illustrated in No. 1, because the edge of the chisel will at once make the granite cut and break off the wrong way and the edge will become rough and with chips out at different places. The safe way is shown in No. 2. Hold the chisel so it will cut in at all times. This causes the granite to break ahead of the tool inward and a smooth edge will be the result.

FOREMAN.

* * *

DRILLS FOR CARVING.

Some granite and marble carvers utilize much more time than is necessary when carving because they do not use the proper tools. The right kind of tools help to carve properly as well as rapidly. After the rough has been taken away and the



form of the decoration is being worked out, one must change his chisels from wide blunt ones to narrow sharp ones, also introducing different sizes of drills. Drilling out the waste between the forms is the safest and fastest process. There is not much danger of lifting off a part of the necessary form because numerous drilled holes leave a honeycomb effect which is very substantial.

After repeated drillings, you then use small, sharp, plain chisels to cut away the remaining part. It is advisable to cut and clean each part as the carving proceeds and by cutting in relief places be sure to leave some drill effect, which will act as a sort of bridge which keeps the parts solid. Ofttimes when there is danger of a breakage, one can introduce a small piece of wood—a match, for instance—that has been cut the required length, and with a small bit of plaster of Paris on each end, it is then inserted into the cavity, which makes a solid foundation to work on. To remove the wedge, do not hammer off, because a jar might

loosen some part of the decoration, but cut through the wood with a knife. Each end is removed by scraping with a chisel held in the hand, but not by a hammer.

Drills for use in a pneumatic hammer are similar for both marble and granite; only the marble drill has more flare than the one for granite, as shown in the illustration. A workman must have a variety of sizes of drills from 1-inch down to ⅛-inch, and several of each size. Never try to drill with one that is dull, for the result will be very slow progress and often breaking off of parts.

* * *

FILLING HOLES IN GRANITE LETTERS.

A good quick, substantial way to get the effect of color in filling holes in granite letters is accomplished in this manner: Use white lead and lead pencil dust. Sharpen a pencil with a long point and scrape the point into dust on some smooth surface. Add the black dust to some white lead and use a knife blade for a palette knife to mix the two ingredients together. The proper color can readily be determined by taking a small quantity on a knife blade and holding close to the granite to see if too light or too dark. If too dark, add more white lead, and if too light, add more black lead. This operation is quickly accomplished, and the proper color is easy to get. The white lead will, when dry, stick to the granite and become hard, and the mended place will not be seen. The end of a raised letter may be filled in this manner with success.

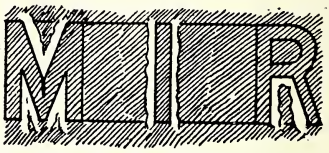
* * *

HOW TO CUT MITRES.

A great mistake in letter cutting is the unevenness of the mitres of such letters as the M and W. The correct way to cut them is to have both on the same horizontal line. These mitres do not show as plainly on light granite and marble as they do on dark stone where the contrast of the polished surface and the cut letter is very great. Even traced letters like those we see on red granites, show this mistake more than any other cut letter for the reason that there is more contrast between the polished letter if raised or the white of a cut sunk letter, on this kind of granite. All letters cut on marble or granite thus should be watched and be cut correctly.

POLISHED RAISED LETTERS.

In cutting polished raised letters I find that the best way to keep from breaking off chips and ends is to cut all ends last. The inside of the M, N, W and letters that miter I have also found out should be cut before the outside. To cut a raised letter,



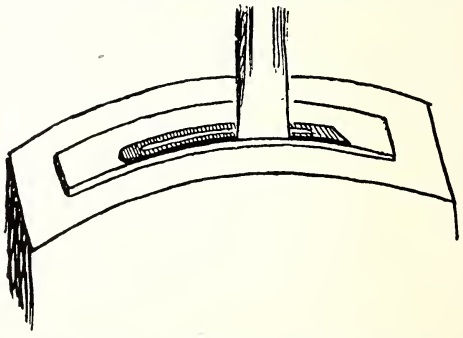
SAFE WAY TO BEGIN CUTTING POLISHED RAISED LETTERS.

supposing it to be an H, four inches long: First rough out at all sides and on both sides of the crossbar before cutting the ends. This is better than cutting the ends first. And when the edges are chipped the same system holds good when they are to be cleaned. Always leave the ends last, for by so doing it insures a more solid bar while cutting the sides, which are more difficult than the ends. Cutting an M and W is difficult, for one sometimes gets the chisel pinched and off comes a corner. By cutting the V shape inside before cutting the outside, and then cutting the ends, is the best way to insure cutting a clear letter, whether they be four inches or one inch long. The accompanying illustration will help make this point clear. J. W.

* * *

LETTERING ROUND TOP MARKERS.

It is difficult to chip granite letters on a round top marker when using a stiff, straight edge, because this cannot be held closely against the surface of the stone, and when you do not hold the straight edge very solid the result is always an uneven line. If the blade of a bevel square or a thin, straight-edged piece of sheet iron is used for that purpose, the result of chip-



CHIPPING A LETTER BAND, USING A BEVEL SQUARE BLADE FOR A GUIDE.

ping is more satisfactory. The thin iron can be bent into the same circular form as the top of the stone and closely down against it. One man must hold the bevel square firmly while another chips the edges with a chisel. Both men must watch the edge at all times, so that a straight, even line can be chipped. FOREMAN.

ROMAN OR COLONIAL LETTERS.

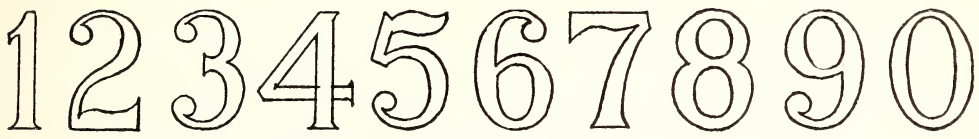
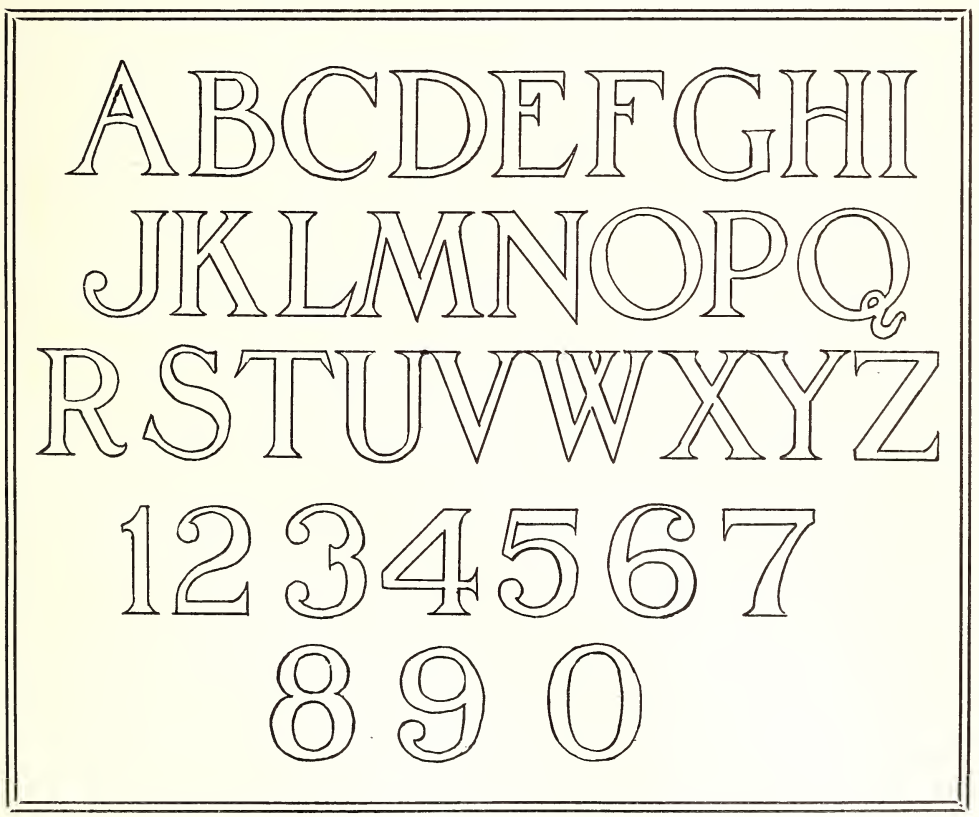


FIG. 19; FIGURES FOR A MODIFIED ROMAN ALPHABET

The alphabet and numerals here illustrated are from the Roman, 16th century. These were used mostly on Colonial monuments and headstones. The letters do not have a mechanical width and can be narrowed or widened to suit the line they are drawn in so that the spacing may be correct; and it is not necessary to change the width of all when one or two have to be transformed. For instance, E, F, H, O, Q and U are suitable letters for changing of width. Letters of this kind are the most artistic of any ever used and can be cut in stone, raised or sunken, to a good effect.

J. W. W.

The figures for the modified Roman alphabet here drawn in Fig. 19 all have the same spacing and guide line as the letters. The guide lines have been drawn, and on inking in, have been left out showing how they look when finished. The beauty of these figures is their graceful curve which starts at the top center in many cases like the 6, 9, 8, 0 and continues in one graceful line to the bottom center. The center of the letter will be seen to be at the extreme outside.



ROUND RAISED LETTERS.

In discussing how to finish a high-class round raised letter, a few words on roughing out may not be amiss, for the reason that if they are not roughed out correctly a high-class finish cannot be accomplished. Start with a one-inch tool and rough out from the centers of all the bars, one at a time; rough out the required depth on each letter before going to another. Do not cut a line at the top and bottom of all letters the first thing, because those top and bottom lines must be cut last to prevent breaking off of bars. The top and bottom of bars are cut one at a time when you have finished the sides of the bars. Then they are cut very slanting. To clear these letters it requires a very careful stroke with a smaller machine, and a good workman should know when he roughs out whether the letters are on the head grain or on the riff. If they are on the head grain they are pretty safe to be cut, but it requires very careful execution to cut a raised round letter on the riff. He must be guided by the knowledge he gains when roughing out how to clean. In cleaning these letters one should, as in roughing out, clear all the sides first before the ends are touched, and the inside of the A, K, M, N, W, X and Y should be cleaned before the outside. Then there is no danger of pinching off the bar. These letters must be left raised a little more than one-half of their width. Most workmen do not raise these letters high enough. A sharp corner must be left at the conjunction of the bottom of the bars and the bottom surface. This is accomplished by always holding the tool straight up and making the cuts with the full width of the chisel blade from the top of the bar to the bottom. It requires many cuts to get it down evenly all along the length of the letter. Do not use the corner of the chisel to cut these bars, for a corner helps lift them more than the flat full length of the chisel. When these sides are down to the bottom on each side and the bar is the proper width, cut off the unevenness near the top and proceed to clean by holding the chisel lengthwise of all bars. Work backward and forward from bottom to top and from top to bottom of each bar until it is smooth. The very last cutting to do is to cut the ends of a letter after it is finished all around. There is then only a very small particle of unevenness left near these bottoms and tops to be cleaned, and the letter is finished. It is always well to have a sponge with water and keep the granite well soaked. This makes cutting easier to the machine and to the man.

When cutting round raised letters always leave the C, G, J, O, Q, S, and U longer than the other letters, for the reason they always appear shorter than the

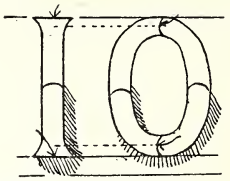


FIG. 2. — UNEVEN HIGH PARTS OF RAISED LETTERS.

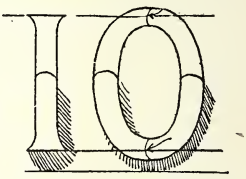


FIG. 3. — HIGH PARTS OF BOTH LETTERS EVEN.

other ones which come full height to the line. They are not in the same plane. Fig. 2 at the top line will show this. The "I" comes out to the line at its full height and the full height of the "O" is in the center of the bar. Therefore, when looking at them, the "I" is higher on the line, for the "O" goes around to the top line from the center of bar. Also the "O" recedes from you and is foreshortened and at all times appears shorter. The bottom is the same, only more so. They should be cut longer than the top one, for there are shadows to contend with. The light is always from a point higher than the letters, which makes the letters throw a shadow downward and letters on different planes will not throw the same shadow. The bottom of Fig. 3 illustrates how a shadow falls from the bottom line of round letters. The distances of shadows marked on this diagram are the same from the top planes. The plane of the "I" comes out square against the line at its full height, and the "O" does not, for the height its shadow will come from is in the center of the bar. To more fully illustrate this, use two small match boxes, one one-eighth inch behind the line of the other. You will see the shadow will be one-eighth short of the front box. Nearly all designs, photographs or monuments in the cemetery show this fault when they have names in round letters, and the larger the letter is the shorter they appear, for there is more foreshortening at the top line and the shadow decreases on the bottom line. Fig. 2 shows how they are commonly laid out and Fig. 3 illustrates how they should be.

SHADING TRACED WORK.

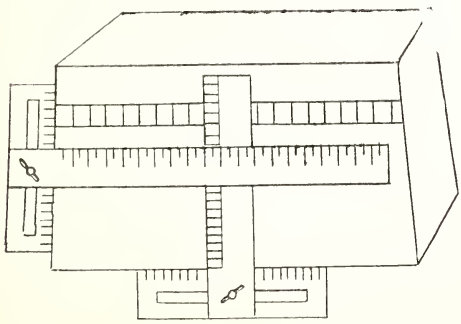
The shading of tracing on Quincy, Missouri, Montello and other granites of similar nature and also marble of dark color to give the effect of bas-relief is accomplished by first cutting a true outline and to give the proper effect they must appear raised. Use a small piece of coarse car-

SHADING TRACED WORK.

borundum which has a sharp edge and scratch evenly on all places that require a shadow or half tone; always use a dry piece to insure good scratching for when wet it dampens the stone and makes the lines too dim to work to any advantage. The illustration shows how this is accomplished.

AN IMPROVED LETTERING SQUARE.

Gus Lynch has devised an improved lettering square which he believes to be a good time-saver and aid to accuracy and uniformity in laying out inscriptions. It resembles somewhat an ordinary T-square,



A LETTERING SQUARE.

but has both blades graduated, and one of them fastened to a groove in the other by means of a set screw. The horizontal blade can thus be placed at any angle and moved up and down the other blade in any desired position. It can be used on either a square or diminishing die, without a center line on the bottom or at the sides, and is of simple construction. It can be made of hardwood or metal, with the vertical blade about one-half inch thick and the horizontal blade one-fourth inch thick.

TEMPERING LETTERING CHISELS FOR GRANITE.

The best way to temper lettering chisels for granite is never to heat the tool over a cherry red, and in drawing it, do all the hammering you do on the edge. When you start to draw the steel, then draw the flat side of the tool to the thickness you wish it, then heat it till it is just turning red and stick it into a raw potato ¾ of an inch. Hold it in tight 6 or 7 seconds and draw it out of the potato and chuck it into your cooling water. When cool, it is ready to grind.

WM. BENSON.

TOOLS FOR RAISED LETTERS.

Editor Asked and Answered: Will some first class workman please tell just what tools are required to cut 2-inch round raised letters? Have an air plant and ¾-inch tool.—J. C., Wis.

The proper tools to use to cut 2-inch round letters are about the same as for other letters. That is, if the letters spoken of are for granite, but if for marble they would be somewhat different.

For granite you should have at least 1 dozen ½-inch plain pneumatic chisels; part of these will be dull and being sharpened by the blacksmith at all times. The other part will be in use, as they will be sharp. In such a kit there should be at least 8 or 10 narrow blades from ⅜-inch to ⅛-inch wide. These are used to cut inside of letters and in small places on the outside.

Before the actual cutting of letters commences the background must be worked down to the required depth. Some workmen use a hand hammer and points. If so you should have one dozen of them, ⅝ inch steel. Other workmen use roughers to work down the back ground; two kinds are used—first, one with four points

made from short ½-inch chisels. Then on top of this work they use another rougher that is 1 inch or more wide that has a double row of teeth, also one that has a single row of teeth. Two of each kind should be on hand. Next on top of the last rougher use a double blade plain chisel 1 inch or more wide for the large places and then a single blade chisel for the small ones. One also uses these single blade wide chisels to clean up the background after the letters are all cut. At least 5 of this kind should be on the work bench. The last one should be a small bush chisel to work over the ground before using the cleaners, as the 1-inch chisels are called. It is always handy to have some of the smaller chisels rounding at the corners, as they are very handy when cutting on the inside of an A, B, R and letters similar.

The tools used when cutting marble letters that are round are about the same as for granite except that you will need tooth chisels to rough out with instead of roughers, and the small chisels must be sharpened in different forms as one needs them. The frosting tool takes the place of the bush chisel when cleaning up the background.

TURPENTINE AND SUBSTITUTES.

The statement has been made that the fumes of turpentine are injurious. These fumes are not injurious, and on the other hand are really beneficial. One of the favorite remedies for cold and sore throat in the South, the home of the pine tree, is to breathe the fumes which arise from steaming water into which turpentine has been poured. Turpentine taken internally has certain curative properties recognized by physicians everywhere.

A Southerner.

For one who wishes a substitute for turpentine, in certain districts they use coal oil or lamp oil the same as turpentine with a small brush wetting 4 or 5 letters ahead of one's work. The odor is not quite so offensive. It does not dry out so quickly while cutting, has the same effect as turpentine and is perfectly harmless when used moderately as you would use turpentine.

Another substitute for turpentine recommended is the following: ½ pint common lamp oil, ½ pint of turpentine. This does not have the disagreeable odor, and is much better in warm weather, as it does not dry so quickly and has more chance to penetrate.

LEADED LETTERING FOR MONUMENTAL WORK.

It is interesting to observe how, in America, certain styles or modes of lettering have been adopted, in spite of the fact that foreign influences have been brought to bear which one would think would be strong enough to turn the tide of fashion in their favor.

That such a turn does not occur is probably a token that the country prefers to assert its own individuality, and calmly goes in its own groove, for better or worse, as the case may be.

Although it may not have occurred to everyone, the custom of placing the family name prominently on the face of the monument, in the place usually set aside for the inscription, is peculiarly American, and until recent years it was unusual in Europe to display the family name prominently on the monument at all. Even now, while the name is often made larger, it is usual to confine it to the base or elsewhere so that it will in no way interfere with the space for inscription, which is always cut on the monument itself.

In considering the evolution of the present day monument, one is forced to the conclusion that after all, the paneled portion of the monument, usually on the face of the die, is intended to contain a record of the interments in the adjacent graves.

Owing to the high cost of land, it is customary in European cemeteries to make several interments in one grave, and if a separate marker were to be placed on the grave for every interment, the result would be ludicrous in the extreme. Consequently the use of the panel for the inscription is imperative.

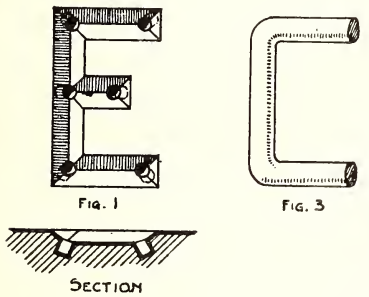
Over there the letters of the inscription are very seldom left with a tool finish only, but are usually painted, gilded or filled with lead.

Little can be said in favor of the painting or gilding. The smaller size of the letters used is the only justification for this class of work, but the leaded letter, carefully handled and artistically considered, may be used to great advantage, giving, as it does, extreme legibility with a complete absence of any garish effect.

The practice of leading letters seems to be little known in the States, and perhaps it would not be amiss to explain just how this is accomplished.

In the first place, let it be said that to lead letters on any polished surface as dark as, or darker than, that of Barre granite, would simply be a waste of effort, as the resulting inscription would be almost illegible. But on the fine axed surface of any light granite or on a light polished surface like that of Balfour Pink, the effect would be very good indeed.

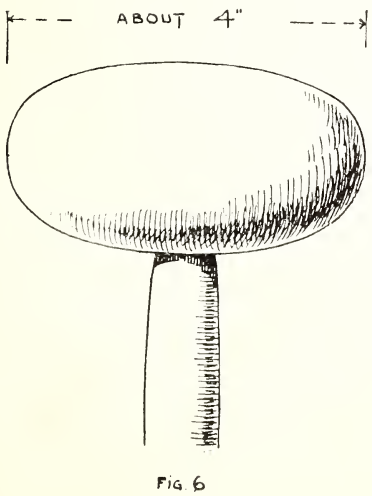
It is necessary to draw out the lettering very carefully as by this process the inscription becomes much more prominent



LETTER CUT AND HOLES DRILLED FOR LEAD.

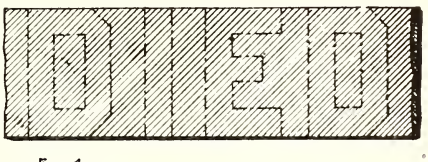
and any carelessly formed letters or bad spacing will be more readily noticed than in an inscription that is cut only.

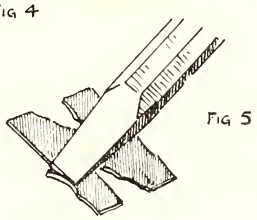
The letters should be kept fairly small in size and light as to width of stem. A well drawn classic letter would perhaps lend itself best for this purpose, but care would have to be taken that the slender parts of the letters were not too fine, as in that case the lead would be apt to become loose, with disastrous results.



MALLET FOR LEADING.

In making a leaded letter it is customary to cut the letters in the usual V sunk manner as in Fig. 1. At each cor-





DRESSING OFF LEAD.

ner and in the center of each bar or curve a little hole is then to be drilled, sloping these holes away from each other in an outward direction so as to form a key to hold the lead in place.

The lead is not to be run into the letter in a molten form, but should be hammered in dry. In some localities it is customary to use lead wire for this purpose. This may vary in thickness from one-eighth to a quarter inch diameter, according to the size of the lettering, but for a letter with stem one-quarter inch wide probably three-sixteenths inch lead would answer.

The lead wire may be bent roughly to the shape of the letter, as in Fig. 3, and hammered in until the letter is filled up fair and level. Where much lead lettering is done it is customary to use a vulcanite mallet for this purpose, of the form shown in Fig. 6. This, however, is not absolutely essential, and a metallic mallet with a slightly rounded face can be used, provided care is taken not to stun the surface of the granite around the letters.

After the lead has been beaten in, the edges of the letter will require to be trimmed with the chisel in order that a crisp, cleancut effect may be obtained.

Sheet lead about one-eighth inch thick may be used in place of lead wire. A strip of lead, corresponding in width to the height of the letters, may be laid along the line as shown in Fig. 4, or each letter may be treated individually. When the lead is hammered in the outline of the letters will appear faintly on the surface. The lead can then be dressed off with the chisel and finished as before. Fig. 5.

By using somewhat heavier sheet lead the letters may be slightly raised above the surface. This adds greatly to their appearance and the result is much better than in the case of the flush letter.

In the case of letters on a polished surface, part of the labor of finishing can be dispensed with. After the lead has been hammered in, the superfluous metal may be pared off with a broad carpenter's chisel or a plane iron, giving a level surface with a minimum amount of trouble.

The greatest objection to this process is that it leaves the letters with a glossy surface. This will darken in time through exposure to the atmosphere. Often the surface of the letters is painted black, but in time the paint will flake off and this plan is not to be recommended.

Ornament in leaded outline work can be carried out with fine and unusual effect. Some notable examples of this class of work are in existence.

Like every other form of ornamentation, leading may be abused, and it should not be used indiscriminately. When, however, legibility is the first desideratum, then by all means use lead. A lead letter rightly made is practically imperishable.

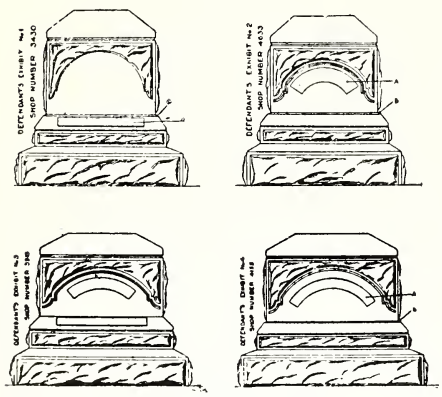
Over in Scotland we thought we had something new in this lead lettering. Imagine our surpise then when our works superintendent, who was something of a Biblical scholar, turned up for us Job 19, 23d verse, and read as follows:

"Oh that my words were now written!
Oh that they were inscribed in a book!
That with an iron pen and lead
They were graven in the rock forever!"

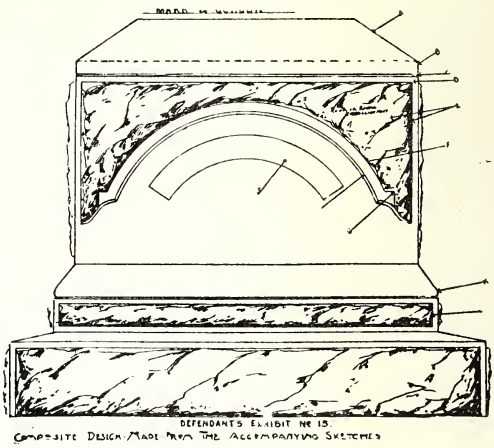
Truly, there is nothing new under the sun.

ARCHIE S. HILL.

THE "LOCKWOOD" PATENTED MONUMENT CASE.



FOUR ALLEGED INFRINGEMENTS



COMPOSITE DESIGN MADE FROM THE ACCOMPANYING SKETCHES

For several years the ghost of the "Lockwood" monument disturbed the peace of the monument trade, to a greater or less degree, throughout the country. The elastic technicalities of patent law claims, with their tendency to grasp at everything in and out of sight, made it dangerous to run the risk of an infringement suit, with the great uncertainty of results, in spite of all previous knowledge and experience. The "Lockwood" litigation, if it teaches one thing more thoroughly than any other, is that monument designs should never receive patent office protection if of ordinary trade production, and that if founded on the principles of art, designed as productions of art, the cause of art is seriously handicapped by any such limitations. It is also true as to the monument trade that a patented design claiming everything is a decided hindrance and stumbling block to improvement in monument design.

The so-called "Lockwood" design was patented by Mr. William H. Young, a monument dealer of Troy, N. Y., who received Letters Patent of the United States, No. 27,115, for the same on May 25, 1897, securing all rights thereby for a period of 14 years.

For a year or two Mr. Young continued to encourage the sale of his patent design and built a number of monuments, until information came to him that Mr. Dennis Daley, a dealer of Cohoes, N. Y., was selling monuments of a design infringing on his patent. Thereupon on December 12, 1899, Mr. Young filed a bill of complaint in the United States Circuit Court, North-

ern District of New York, against Mr. Daley, which in due course was argued upon evidence taken for both sides, and a decision rendered for the complainant, on February 25, 1902, awarding him the royalty fee of $250 and costs amounting to nearly $200.

The case was appealed by Mr. Daley to the United States Circuit Court of Appeals for the Second Circuit, and the patent was presumably again sustained, no written decision being rendered, and the decision of the court of trial practically upheld. The decree was filed March 30, 1903.

The patent being thus sustained by the New York courts, there ensued a period devoted to the collection of royalties and fees for permits, with prospects somewhat alarming for both dealers and manufacturers of monuments using details similar to those covered by the patent.

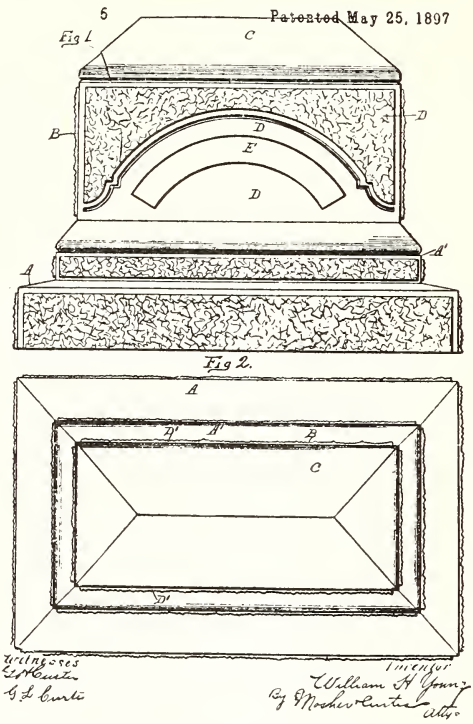
On October 23, 1903, Mr. Young made an assignment of the patent to Messrs. Mosher & Curtis, attorneys of Troy, N. Y., who in turn assigned the same to Mr. John W. Crier, Green Island, N. Y., on January 9, 1904.

The search for infringements led those interested in the patent into the manufacturing center of Barre, Vt., and no satisfaction being obtained short of legal proceedings, a suit for injunction and statutory penalties was instituted by Mr. John W. Crier against Messrs. Alexander Innes and William Marr, administrator of Alexander Cruikshank, deceased, the defendants being backed by the Granite Manufacturers' Association of Barre, Vt.

It can also be readily understood that upon the validity of the patent practically rested the whole case; but as the New York courts rendered no written decision, and only made a decree covering the statutory fine and costs, no positive opinion was expressed on the main question. The complainant averred that in all the principles declared by the courts in previous guiding decisions, such principles as inventive skill, originality, novelty, etc., were contained in this patent, and presented numerous decisions upholding the claims.

The case of Crier vs. Innes & Cruickshank et al. for infringement of the "Lockwood" patented monumental design, was argued before the United States Circuit Court for the District of Vermont at Brattleboro November, 1907. The judge rendered his decision in favor of the defendants, holding, in substance, that the design was not patentable, being merely an arrangement of old, and often used, forms in all its parts. We quote as follows from the judge's decision:

The answer in substance denies Young's invention as an original design for monuments; denies that the same is useful; disclaims knowledge of said letters patent and denies their validity; avers that every element of the design in question was in common use before said letters patent, and challenges every allegation in complainant's bill of complaint.



DRAWING FROM PATENT SPECIFICATION OF "LOCKWOOD" MONUMENT.

Issue was joined and a large amount of evidence taken.

The patented design represents a monument with a lower and upper base and upon the upper base rests a die which is surmounted by a cap. The general form of these members is rectangular, with two elongated sides. The vertical sides of the bases and die exhibit uncut rock. One or both of the long vertical sides of the die are ornamented with a hammered or polished entablature in the form of a central arch extending nearly to the top of the side, leaving above the entablature a projecting tablet of rockwork extending across the upper side of the die comparatively narrow at the middle of the side and gradually increasing in width toward each end. Upon the face of the entabla-

ture may be placed on arched tablet having its upper and lower border-lines parallel with the border-line of the arch of the entablature. The leading feature of the design consists in "the ornamental configuration of the die," and the letters patent conclude as follows:

"I do not wish to be limited to a plane surface for the arched tablet, as the same may be cut to form special designs with my general design. The arched tablet may be either intaglio or relievo. What I claim is new, and desire to secure my letters patent, is—The design for a monument herein shown and described."

The general configuration of this patented design is old. It is simply the sarcophagus style. The evidence shows that the two bases of uncut rockwork were in use many years before this patent was obtained. The use of the die with an arch over the tablature, ornamented with spandrels of different design, some of skilled carving, some of plane hammered surface, and some of uncut rock is old in the construction of sarcophagus, obelisk and cottage monuments, and as to sarcophagus monuments, rectangular designs are old in use. Sarcophagus caps of monuments of the same rock shaped configuration as that of this patented design were in use many years preceding these letters patent. Just such an overhanging arch of rock-faced spandrels extending across the top, as in this patented design, is not found in any of the exhibits of the old designs, but the same idea is found in exhibits 60 and 83, if not to say others; and whether the patented design is an improvement upon the old art is more a matter of taste than of inventive genius. By putting a die of defendant's exhibit 69 on the two bases of defendant's exhibit 59, and capping it with the cap of defendant's exhibit 25 or 26, or applying to the defendant's design 68 the uncut rockwork of defendant's exhibit 25, we would have a monument so nearly resembling this patented design that, if this patent is sustained it would be an infringement; to the ordinary observer it would look the same and that is the test of infringement, and the four monuments made by the defendants would be deemed an infringement.

A person who prefers a sarcophagus monument to any other style and has a special fancy for uncut rockwork, visiting a cemetery in which there has been placed the Stewart monument, defendant's exhibit 85, and a monument constructed from the design of defendant's exhibits 68 and 25, and concludes to use the two bases 85, the die of 68, by changing the spandrels over the entablature from carving to uncut rockwork, and using the cap of 25, would have a monument in general appearance like this patent, and should he prevail upon some stone cutter to make a monument to suit such a taste, he would quite likely get that stone cutter into chancery for having infringed this patent; yet nothing would have been done except to assemble old parts. No one of those elements contributes to the completed result any new feature except to meet the taste of the person making the selection, and therein applies the doctrine in Pickering vs. McCullough, 104 U. S. 310:

"No one of them adds to the combination anything more than its separate independent effect; no one of them gives any additional efficiency to the other or changes in any way the mode or result of its action. In a patented combination of old elements, all the constituents must so enter into it as that each qualifies every other; to draw an illustration from another branch of law they must be joint tenants of the domain of invention, seized each of every part per mi et per tout, and not mere tenants in common with separate interests and estates."

It was said by Judge Aldrich in Perry vs. Hoskins, 111 Federal 1002, relative to a design for a monument:

"All the features in detail must be treated as old, for the stone cutter's art, as known and practiced from a very early period, has covered all conceivable shapes and forms in monuments in statuary, and the combination does not, as it seems to me, amount to a new and original design."

The lines of a draftsman and the chisel work of a sculptor of this day and generation are practically an imitation of old lines and old works. I somewhat question whether Congress by its legislation on patents intended to include monuments as works of manufacture, but, assuming as such was its intent, there was but a small field opened to the genius of invention in monumental designs.

It is claimed by this assignee of the patent in question that the ornamentation of the uncut rockwork overhanging the entablature on the die is a special feature and novelty. Evidently, from the comments and decision of the learned and experienced judge who tried the Daley case, the patentee established that fact from the evi-

dence in that case, but it does not so appear in the case that is before me. The same idea is found in the die of several of the defendant's exhibits, the only difference being in the shape and proportions of the die and the good taste manifested in the general configuration of the whole monument. If a mere change in shape and proportions is to be construed as a patentable novelty, then the defendants have not infringed, for the monuments of their construction on which the complainant bases this action, differ from the patented design, in both shape and size; but in the design this special feature of the die as set out in the letters patent is not the basis of the patent. The patent is a design of a complete monument and, from the evidence in this case, it appears that it is composed entirely of ideas that are old. The only new thing about the complainant's design that I am able to discover from all the evidence in the case, is its shape and form as the result of the assembling of old parts and old ideas.

Justice Swayne, speaking for the Supreme Court, therein said:

"A mere carrying forward of new or more extended application of the original thought, a change only in form, proportions or degree, the substitution of equivalents, doing substantially the same thing in the same way by substantially the same means with better results, is not such invention as will sustain a patent. These rules apply alike, whether what preceded was covered by a patent or rested only in public knowledge and use. In neither case can there be an invasion of such domain and an appropriation of anything found there. In one case everything belongs to the prior patentee; in the other, to the public at large."

In view of all the evidence in this case as to the state of the prior art, I am unable to find in this design invention. It is the skill of the draftsman.

The pleadings raise an issue of fact as to whether defendant Marr, an administrator since the death of Cruickshank, has been interested in the manufacture of the monuments in question. The complainant claims that the defendants have made four monuments that infringe. I find, from the evidence, that those monuments were constructed before the death of Cruickshank, and that neither Innes, his partner Cruickshank, nor Marr, the administrator of Cruickshank, knew of the existence of this patent or that they were making monuments the design of which was covered by letters patent. For the reasons above set forth, I think the bill should be dismissed, and it is so ordered. Decision as to costs reversed.—James L. Martin, Judge.

MAUSOLEUMS AND MAUSOLEUM WORK

ENDOWMENT OF PRIVATE MAUSOLEUMS.

By Frank Eurich, Superintendent Woodlawn Cemetery, Detroit.

Suitable and comprehensive rules and regulations should be established for the proper construction of mausoleums and emphasized strongly the equally important necessity of finding ways and means to provide adequate funds for their future maintenance. From time to time for many years this subject has been before cemeteries. It has, however, never received the earnest thought it should have had and therefore very little has been done to bring about some action looking for the future care of these structures.

The increasing number of mausoleums going up every year, the sharp competition threatening to cheapen these structures are sufficient reasons why cemeteries should no longer show apathy regarding this subject, but should give it the most thorough and careful consideration and follow same by such action that will be no hardship on the owners and will be a safeguard for the stability and permanency of these structures.

There is no doubt that this is at the present the most difficult and troublesome problem for cemeteries to solve satisfactorily. It is as important or even more so than the permanent care of the cemetery itself.

Inasmuch as the cost of future maintenance of such structures will depend almost entirely on the material and construction it will be in place here to discuss a few important items entering in the problem.

For instance it can easily be understood that a building constructed of large stones with a minimum of joints, particularly in the roof construction, would require much less repair and looking after than one built of numerous small courses with a multiplicity of joints.

Again a building having a flimsy light interior construction of crypts and marble lining, the latter usually pinned to outer walls with light copper wire and plaster of paris will require much more attention, and much sooner, too, than one in which the interior is of solid material and constructed so that it would be self supporting.

Of vast importance and not appreciated as much as it should be, is the matter of ventilation.

It has been said and the idea no doubt in many buildings carried out, that mauseloums should have only dead air spaces, and some designers even claim that the entire elimination of air spaces is the proper thing.

I think that is a grave error; my own observation and experience have proven to me beyond all doubt that the larger and more air spaces provided and having the proper inlets for the atmosphere to enter and permeate all of them, the less condensation will appear and this will be more quickly neutralized, if any does appear.

There should be an ample air space below the floor of every mausoleum to which openings should be left passing from the air spaces between the outer walls underneath the floor, so that all of them will communicate.

I have also found that if the upper air inlets are more numerous than the lower ones, a more effective current of air is produced on the proven theory that warm

air entering the upper ducts will create a draft and draw the cool air through the lower ones.

In designing a mausoleum the fact must not be lost sight of that no provision can be made for heat. For that reason I contend that the next best thing to do is to provide liberally for air to enter and permeate between and through the various parts of the building, thus assisting in evaporating moisture, which the materials usually used in mausoleum construction absorb in an astonishing degree.

Adjustable shutters might be used to close the exterior air inlets during the winter months, to be opened again early in spring.

I suggest this because we have found it beneficial to do so in our public vault which, without any mechanical appliances for purifying the air, has shown eminently satisfactory results in being dry at all seasons of the year.

In high and dry localities and where there are no severe and sudden climatic changes, precautions of this kind probably would not be needed.

If by proper methods of construction leakage is prevented, and a dry interior is secured by ventilation, the most destructive forces affecting the durability of a structure have been eliminated.

It seems to be an admitted fact that granite is the best material for mausoleum construction and no doubt it is. In no other material is it possible to obtain such large pieces as are often required for roofs, etc. This enables the designer to make use of large stones, particularly for the roof construction, thereby reducing the number of joints, which is a very important point gained for the durability of the structure.

Complete plans and specifications should be prepared embodying everything that can be devised to produce a structure as nearly permanent as possible.

The cemetery authorities, after passing and accepting the plans, must see that every provision made by the designer will be faithfully carried out.

When this is all done and the structure built according to requirements set forth and all precautions have been taken to erect a good, substantial building, we are still confronted with the fact that it will not stand forever without some provisions for its preservation and care.

No matter what the initial cost is and no matter how well the building is constructed, all this will not be proof against or defy the constant and powerful natural forces, which work toward dilapidation and decay.

Some plan must be devised to guard against the decay, or at least counteract the same and retard it as long as possible.

It is difficult to conceive that a desire, which has prompted the erection of a mausoleum at considerable expense, should not bring with it also the desire to make provisions that the structure will be cared for, protected and preserved.

This may be accounted for partially by the slowness with which cemeteries have realized the importance of the matter, coupled with the fact that the owners were led to believe that no provisions for care would be required, that the structure would stand for ages without further care. This, we know, is absurd.

Viewing the question from all sides and in a broad sense we must agree that cemeteries cannot afford to allow mausoleums built and let them become burdens in later years for the want of money to keep them in repair.

Their only recourse is in rigid rules governing the erection of the buildings and then making it compulsory that every building be endowed sufficiently to keep up the repairs. If this is not done and it is left discretionary with owners or their heirs to provide funds voluntarily the cemetery will have to expect burdens and complications of an unpleasant nature on their hands in the future.

There is no reason in my mind why legislative aid and support could not be obtained to enforce proper rules pertaining to the question of future care of mausoleums, especially if the state health authorities are informed what conditions might be expected from uncared for mausoleums in the course of time.

The question of what items should be covered by permanent care and the method of arriving at the required amount of money necessary for that purpose cannot be separated.

No set rule or schedule of rates can possibly be figured out that would be suitable for all cases; climatic conditions, materials, methods of construction must be considered, when calculations are made for the cost of care.

Probably the wisest and most equitable plan for both owner and cemetery is the one under which a contract is made suitable to the existing conditions of each

case. This contract will specify what responsibilities the cemetery assumes, it will set forth what work is to be performed and how much each item of work will cost. The cost is based upon a carefully prepared estimate, the items of which will be enumerated separately in the contract.

The amount resulting from this estimate, capitalized at three per cent, will produce the Repair or Care Fund required. The cemetery should be entitled to a small percentage for making the proper investments and that, too, must be taken into consideration.

Among the essential and most vital items to be covered by care are an annual cleaning of the building and a thorough inspection and repair of all joints on the exterior as well as on the interior. The life time of a structure depends mainly on the precaution of keeping all joints in good condition.

Provision should also be made for frequent janitor service involving sweeping and dusting, wiping the interior and regulating the opening and closing of ventilator, etc.

If mosaic interiors are present they need special examination after every winter, loose pieces must be reset, etc. Glass in windows and doors may become broken in various ways. Provisions should be made for repairs, breakage, etc.

Bronze work, such as doors, grilles, handles, hangers, rosettes, etc., must also be remembered in the estimate.

If for any reason the income from the fund is not all needed to do the required work any one year, the balance can be added to the capital so that, if in the future extraordinary expenditures might become necessary, there will be funds on hand to take care of them.

In conclusion, I desire to say that personally I am opposed to laying the dead on shelves, either in private or public mausoleums, in the present day accepted manner, which is devoid of all precautions in a sanitary way.

Earth burial or preferably cremation are decidedly better.

Mausoleums, however, have come to stay, because the wealthy want them, and it remains for cemeteries to protect themselves against future legacies, which will become heavy burdens unless care funds are established.

Statutes in all states provide that cemeteries must make provisions for the permanent care of their lots; why not invoke the aid of legislature also to compel cemeteries to formulate and enforce rules making it compulsory to endow all mausoleums?

With that accomplished it will be comparatively easy for each cemetery to work out a plan best suited for its conditions.

MAUSOLEUM CONSTRUCTION AND ENDOWMENT.

By Charles G. Blake.

Referring to the discussion on mausoleums at the cemetery superintendents' convention, it is said:

"The frequency and costliness of repairs even with the higher and expensive type. . . . It is needless to speak of the low priced buildings on which, in most cases, the construction and material employed, far too often make early failure certain."

The inference here is that because so many expensive buildings have not been durably constructed, the less expensive buildings would necessarily be more susceptible to deterioration. On the face of it, this seems good logic, but it is the old story of not having all the facts.

My experience has shown me that these expensive mausoleums, which have required expensive repairs, have been built from architects' plans. Mausoleum designing by architects is a mere incident in their experiences. They are accustomed to building buildings having constant personal attention by janitors or others, and these buildings are heated in cold weather.

So when they attack the mausoleum problem they do not construct them on the lines requiring the minimum of attention to enable them to withstand the effects of the elements.

The walls and foundations of Greek temples, though built of comparatively inferior material as to durability, are standing today, except, first as to damage done deliberately by man, and, second, as to their roofs. The buildings were too large to make the roofs in large pieces, and they built them of small pieces.

These expensive mausoleums to which the superintendent doubtless refers as re-

quiring rebuilding have the same defect, viz.: the pieces in the roof are so jointed that it is a weak part of the structure, just as the roofs of the Greek temples were their weakest spot.

Buildings built on the lines of such mausoleums as the Gary in Wheaton, Ill.; Tenny at Methuen, Mass.; Ziegler at Woodlawn, New York, and the Brand at Chicago, will stand because they are built of good granite and the roofs are so constructed that instead of being the weaker part of the building, they are the strongest part of the building, binding the walls together instead of being merely supported by the walls. Inexpensive vaults are built on the identical durable construction that these vaults are built on, so that it does not follow at all, because certain very expensive mausoleums have required a great deal of repairs, that less expensive mausoleums will be less durable. It is the construction and material which counts, regardless whether it is a low priced or an expensive mausoleum.

Good architects naturally design beautiful designs architecturally, and many times their desire for variety and for an elaborate design leads them to put up buildings which have architectural merit only and not durable structural merit.

The desire not to be buried in the ground is inborn; even Indians frequently placed their dead in tree tops, and that feeling will always be with us.

Therefore, instead of combating it generally, the cemeteries and dealers should co-operate in having them built rightly.

In reference to Mr. Eurich's address on "Endowment for Mausoleums," I will advance just a few comments.

I agree with him that cement, beyond a question, has not been satisfactory for a family mausoleum.

I agree with him that closer scrutiny should be given mausoleum plans, because so many of them in years past have been put up improperly constructed.

I agree with him that roofs should be in large pieces, with a minimum of joints. I do not think, however, that it makes much difference on the side walls except that the more joints the longer it will take to repoint the building when it becomes necessary.

If the joints are thoroughly grouted to start with, the only extra expense of having more joints, would be the cost of repointing, which would be a comparatively small item with the man on the job. Sometimes more joints make a better-looking building, as they preserve the scale of the building better, speaking architecturally.

It is, then, a question of whether one desires such a design to have a better architectural effect, or save additional expense of pointing.

Small stones are only necessary in some designs; in the majority of designs large stones are best, any way one looks at it, except, perhaps, the limited expense on over-size stones.

Marble lining, if properly wired, wires being babbitted into the granite, can be made so it will be durable, but as Mr. Eurich intimates, granite on the interior is far superior.

Many of the small mausoleums are built without slate lining at the backs of the crypts, the shelves being only supported with metal pins led into the granite wall. We have not built one in this way in twenty years, believing, as we do, that a partition between the crypts and main wall is absolutely essential.

I agree with Mr. Eurich that dead air spaces, advocated by some, are wrong, but on the other hand, I think Mr. Eurich is mistaken in going to the other extreme of large air spaces.

His theory is, the larger the air space the less condensation will appear.

Condensation is caused by warm air striking a cold surface, the moisture in the atmosphere immediately attaching itself to the surface.

Open a mausoleum suddenly on a warm day, step inside and observe at once the condition of the interior, and it will be found to be dry. Look at it a minute or two later, and it will be found covered with moisture, caused by the large volume of warm air coming in.

If the opening be small, the air changes gradually and causes comparatively little condensation.

In our opinion, the ventilator opening should not be large, merely enough to create a gentle, continuous flow of air between the lining and main wall.

As to crypts, there is a difference of opinions, but I hold the theory that crypts themselves should not be ventilated at all, but should be sealed tight.

Mr. Eurich makes two points which are interesting, and I shall take pleasure in giving them further study, namely:

First: His theory there should be more

ventilation in the upper part of the building than in the lower.

Second: His adjustable shutter theory.

Off-hand, the first one does not strike me as being right, for the reason that the air outside is usually warmer than air inside, as it enters through the upper ventilator it simply passes from that side and goes out the upper ventilator on the other side, whereas, if the warm air enters the lower ventilator, it will naturally go upwards to the upper outlet.

Mr. Eurich's main point made, "Endowment" is beyond argument and a very desirable and proper idea.

In conclusion, I respectfully suggest that there should be less antagonism toward mausoleums on the part of cemeteries with an increased antagonism toward improperly constructed mausoleums.

Antipathy to burial in the ground is widespread, but most of us have to forget that feeling and be satisfied with six feet of Mother Earth. There are many thousands who do not have to be so satisfied and will demand it.

Therefore, it is up to the cemetery authorities and mausoleum builders, in the interest and uplifting of their life's work, to see that every reasonable precaution is taken to make them durable.

VENTILATION AND CONSTRUCTION OF MAUSOLEUMS.

(Discussion at Cemetery Superintendents' Convention.)

James Currie, Milwaukee: Mr. Eurich has just made the remark that in order to overcome the evil effects of condensation the remedy was ventilation. There is the point I was to direct your attention to, and I will relate a little of our own experience in that line.

A few years ago a mausoleum was erected in Forest Home Cemetery at a cost of approximately $25,000. The architects, a leading New York firm, held themselves responsible to the owners of the mausoleum here for its durability for a certain number of years—in fact, it was indefinite. Within four years from the time of the construction of that building a large part of the mosaic had fallen from the ceiling; the rough stone, some weighing over 20 tons, had moved over an inch horizontally. It was not difficult to determine the cause. Condensation had done the damage. We watched that very carefully when the conditions were favorable for condensation, which, as those of you who live around the Great Lakes know, is quite frequent during summer as well as winter. We watched the conditions there, and I am not exaggerating when I say that at times the interior of that mausoleum by reason of the ventilation was just as wet as you could possibly make it with a hose. At other times it was quite dry.. Now you see the theory and it is well understood.

During the winter in Milwaukee and along this shore of the lake and all our lakes, particularly on this side of the lake, when we have a sudden rise of temperature, which we frequently have, carrying with it considerable humidity, and the temperature of the structure outside and in is down to freezing or perhaps the zero point, it is simply a question then of the warm moist air condensing on the surfaces. Now, can you keep it on the surface? You can to a certain extent. But if you provide ventilators you simply allow it to pass into the air spaces, and instead of the moisture penetrating from the exterior surfaces, you will have it penetrating the joints and surfaces from both the exterior and interior surfaces of your air spaces. So that you will have the evil at work from both sides. The joint absorbs the moisture. It is then followed by more or less severe frosts, expansion takes place, and there is a little displacement; only a little perhaps at first, but that little, if it is no more than a mere hair, becomes a pencil mark, and then it is only a question of time until it is widened to any extent—as I said in the case referred to, one inch within three or four years.

That was the condition of affairs. The question then was how to remedy the matter. The condition showed itself. There was the problem; what was the remedy?

The architects were notified, and they placed the matter in the hands of D. H. Burnham & Company of Chicago; and you all known that Burnham & Company stand perhaps the highest today among the archi-

tects and engineers in the United States.

Burnham & Company viewed the situation; they recommended more ventilation. We took exception. The owners of the building admitted that they believed we were right. It seemed reasonable. Experts were employed by Burnham & Company because we had taken the position we did, and at last to settle the matter the suggestion was made that we allow Burnham & Company, or at least the other architects through them, to reconstruct that mausoleum in any way they thought best —under protest. It was done, and they provided as much more ventilation as they could. They put in a great deal of money, and when they got through they had no more than finished that work along in December when we had a condition such as I have described. The man who was willing to bet with me any amount of money that his plan was going to remedy the whole evil, telephoned me in the morning to say: "Mr. Currie, you are right." I replied, "About what?" He said: "This place is dripping wet this morning." "Well," I said, "I knew it would be."

The architect took the matter up in person. He wrote asking for conditions, and he immediately, in a very courteous letter, wrote us that the position we took was right, and said that he had given orders to shut off all ventilation as far as possible.

I have occupied your time in considerable length in reciting one of our experiences. If any one of you who have opportunity will observe conditions when the weather is right (though you will not find it happen every day) you will readily detect the moisture, and with a little experience you can tell just when to look for that condition.

You will find if a building of that nature is constructed without ventilation, and you depend simply on opening the doors on favorable days to air the building out, you will keep the air pure and there will be no occasion for any further ventilation. In fact, you find nothing except that little stuffy feeling that could easily be remedied by opening the door once in a while. But on a favorable day open the door of any one of those mausoleums when you go in, and observe the interior finish, you will find it to be perfectly dry if it is porous, and if it is marble or granite or any surface of that nature you will observe it is quite dry. Then in 10 or 20 minutes you will begin to notice moisture. Leave the door open long enough and you will see the water trickling down the wall. That speaks for itself.

Now, since we must apparently have a certain number at least of those buildings, as Mr. Eurich has suggested, we should provide as few joints as possible, because it is not in the material itself that the trouble arises, but in the joints. There is not a single building in Forest Home that has not given away more or less. The builders of the latest one pointed to it with some pride, and when I was objecting quite earnestly to a prospective purchaser, they said: "Mr. Currie, we know you will not find any of those conditions present in the vault which we constructed about three years ago." I said, "I have not looked particularly, but let us see." We went around there and found that the roof stone had moved about half an inch, and down at the base there were cracks that I could almost place a card in, which had already started. There was no further argument. It is only a question of time when that building will go to pieces and have to be rebuilt. One remedy is to repoint from time to time, and very frequently see that none of those cracks appear; if they do, close them.

Mr. Carter: I would like to ask Mr. Currie if this ventilation he speaks of extends into the corridor of the building, or into the crypts, or merely between the walls and the crypts?

Mr. Currie: In the case that I spoke of in particular, the ventilation provides for extensions into the corridor and into the air spaces, because the air spaces, I believe, ought to be provided, but it should be dead air spaces—into the spaces over the ceiling and in the walls and about the floor. The air was taken from the outside, as described by Mr. Eurich, and proper means followed to let it pass out under the eaves, making, as was supposed, a circulation.

Mr. Carter: In the remedy applied afterwards were the ventilators entirely closed?

A. Why, by it the ventilation was cut off. The ventilation was provided along in the frieze, through rosettes. I do not remember the number, but a large number; and in order that this air when taken from the interior of the building should pass directly into the atmosphere, copper tubes were provided to each opening. Some one remarked, while the structure was being rebuilt, "This looks like a distillery." Every bit of ventilation was carried to the

apex, and carried out there by a ventilator; we shut off all we could; there is still a little ventilation in the door that could not be cut off.

Q. You did not state what the result of this was, what the outcome of closing the ventilators was. Was it an improvement?

A. It reduced the condensation very considerably in the case referred to, and in other cases where no ventilation is provided, and where the crypts are hermetically sealed, we have no condensation at any time if the door is kept closed.

Q. Why were not all ventilators closed if it was an improvement?

They closed all they could; but the door was made with a grill in the panel and they screwed a plate on the surface of that, and it is not quite tight; nor is the door quite tight, being of bronze; but where we have a snugly-fitting door we have no trouble.

Q. It is your opinion that if these openings are closed, and these small places closed up, the remedy would be complete?

A. It is my opinion if all ventilation was cut off, and it was possible to cut it off entirely, so that there would be no change of air during certain conditions of the weather, we would have no condensation of the interior of the building or the air spaces.

Q. The defects that you refer to were entirely in the roof?

A. No, the roof and the side walls, the entire structure was affected.

Q. The mosaic also came down by the side walls?

A. Yes, that was caused by the dripping of the moisture or water from the roof stones where the condensation took place, falling onto the mosaic work, being frozen into the material and forcing the mosaic off.

Q. How large a building was this?

A. Approximately 22x22—I am guessing at it.

Q. What type of roof?

A. The roof was on the horizontal plan, if you understand what I mean by that. Instead of being a hip or slanting roof, the stones by reason of the size of the structure, had to be in a number of pieces. Vertical joints were avoided as much as possible. The original plan was modified, doing away with the ordinary roof construction, and the horizontal plan adopted, each stone lying on its bed, so that there was no lateral pressure on the building.

Q. And about how many stones approximately were there in the roof?

A. I could not say—I suppose about a dozen pieces, perhaps.

Q. And the number of vertical joints?

A. There were a few vertical joints, yes; but observe the point I make there, and which made the greatest impression on those who studied this particular problem; these stones, not by reason of their own weight, because they rested in a horizontal position on the walls, but by reason of the expansion of the ice, were forced out laterally until the vertical joints were an inch in some places and even a little more out of place. Those stones weighing 20 tons were forced laterally by no other force; there was no other force present than just the ice, which was caused by condensation.

Q. The information you have given us is based entirely on your experience with this one building?

A. No, it is not; but I do not want to weary you with the discussion of the whole question as it relates to my own experience. My experience is that this condition is present in every cemetery that I have observed. In some cases where I was told that they had no condensation, I found it present. For instance, in a cemetery not 100 miles from Chicago, where Burnham & Company invited me to visit them, I would find them quite dry under those conditions. I was prepared to say to Burnham's representative that I had already examined these mausoleums and found that condition, because I had been studying the question for some years.

When I was studying this question of vault and mausoleum construction I visited several cities in the United States, to make inquiries, and see, as far as I could, for myself, the conditions existing. Among the cemeteries visited was Greenwood Cemetery; Mr. Wells was then the superintendent. I stated the purpose of my visit. I had met him before and he was always very courteous to me; but he took particular pains on that visit to show me the several vaults and mausoleums that had been affected in almost the way that I described. I asked Mr. Wells what, in his opinion, was the weakest point in mausoleum construction, and his answer was, roof. As we drove around he pointed out one roof which had been set in his time in Greenwood Cemetery, once; another, twice; and another, three times. Why?

For the same cause. Some of it was due, of course, to the rain getting in, and the condition is aggravated as soon as your joints are open enough to allow the rain to get in. But that does not affect other parts of the structure where the joints are all horizontal and are affected in the same way. I will not say anything more about Greenwood, because Mr. Grassau can tell his experience; but that is what I found in my visit to Greenwood, and all through during a period of 30 years and more I had such an experience as I have described. Ours was perhaps an aggravated case; it was perhaps on what you might term an aggravated scale. But it showed what destruction could be wrought in such a short time, due, in the initial process, at least, in the first stages of disintegration, to condensation.

Gentlemen, I want to say you cannot get away from it unless you heat your building. During the course of an argument on this subject the statement was made: There is such a building in Egypt, and another one in Persia, and another in Greece, etc., that have stood the test of thousands of years. That is true. I will point to one familiar example, the obelisk in New York and its replica in London. These needles stood for thousands of years on the banks of the Nile, without apparent disintegration. How long did the obelisk stand in New York before it began to go to pieces and had to be treated? It is still going to pieces, and if the structure had not been waterproofed at great expense, the exterior would have been destroyed and the hieroglyphics obliterated. In 1884 I visited the obelisk in New York, and that same year, a few weeks later, the one on the banks of the Thames in London. I made inquiry and found that the two obelisks were practically the same when moved from the Nile to New York and London. But the one in London was in much better condition than the one in New York. And why? Because of the severity of our climate, the moisture of the frost, which we have to contend with.

All we can do then is to make our buildings as near indestructible as possible, taking care that the plans provide for the very best construction. A building of this kind may be erected with some degree of carelessness as to the number of stones used and the manner in which they are laid; but a structure which never will be heated, subject to the conditions I have described, will go to pieces in a much shorter time than a building which is occupied and heated.

W. C. Grassau: There is no doubt condensation immediately starts to work havoc with the building. That has been demonstrated in Greenwood dating back to 1845.

I also agree with Mr. Currie and must take exception to Mr. Eurich's position on the subject of ventilation. We have plans submitted quite frequently by the same firm, and they show great ability, so-called, in specifications, and I will make this statement, that in twenty years' experience I have yet to find an architect who can prepare off-hand a plan for a mausoleum. I can include in that category the greatest architects who have submitted plans to Greenwood which I have had to correct.

I do not agree with Mr. Eurich on the subject of ventilation, because we have had a great many so-called ventilating experts, who have received patents from the patent office, on very beautiful and complicated systems of ventilation which in practice have proven unsatisfactory. I do not think I need to mention the names, because they are advertised sufficiently; but I feel justified in asserting that no cemetery shows good results from any of these systems. My observation leads me to conclude that Mr. Currie's contention in this respect is correct.

Another objection applies to the subject of ventilation in New York, at least (I do not know what the laws of Wisconsin and Michigan are in this respect), and that is that the Board of Health will not permit us to ventilate in accordance with the ideas of some of our best men. Everything must be hermetically sealed under the law of the Board of Health.

I am not in favor of air spaces, either. I have often stated that this alluring system of ventilation by means of drain tiles is fine in theory, but of little value in practice. This has been proven, I think, many times in Greenwood.

The subject of roof construction, causing this movement that Mr. Currie has referred to, might have been originally started by interior condensation; but I do not think so, because the condensation will go down, not up. The trouble there is in the open joint, that you cannot close up unless you lap it.

Mausoleums constructed by a number of concerns I have watched for fifteen years and have not seen them move a fraction of an inch; the roofs stand and are standing today without having been even re-

pointed. The interior stands today, and in most cases the system of ventilation has been almost absolutely disregarded. They put a little bronze plate on each side near the top of a so-called air space of about an inch, and when they set the marble up and the plaster is behind it, the air space is blocked up so there is practically no flow of air through it, and it is perfectly dry.

Mr. Eurich: We have, of course, buildings that are not over 12 to 14 years old, and among them is one building that is thoroughly ventilated.

Mr. Grassau made a good point when he said that the little air spaces that are usually provided by the ordinary builders are so small that they are almost choked up; so that in reality there is no air space, and and in that way condensation cannot be taken care of. And this one building I have particular reference to was designed by an architect and not by a constructor, and he and I got the plans up together on the basis of having big air spaces. We have 4-inch air spaces between the outer and inner construction. In Detroit the temperature changes sometimes rapidly from morning to afternoon, so that the condensation will appear. I admit that in my paper. It does appear. But the same air that goes in that is damp is followed by dry air which takes care of the condensation.

I spoke of closing up the ventilators in places where we thought best, and we did that in our public vault, and I can say positively that the little condensation that appeared on the outer surfaces was taken care of rapidly.

The point made by Mr. Grassau that condensation falls and does not settle, is correct.

As to the mosaic work, I would like to ask Mr. Currie how long that mosaic work was in that building?

Mr. Currie: Three or four years.

Mr. Eurich: I rather think myself that probably the construction was not of the very best character, and that rain must have entered into those joints before, because I do not think in so short a time condensation will destroy good material and good work.

I am not obstinate and that is the reason I am glad to see this controversy taken up; but my experience is that larger air spaces are omitted because the buildings cost so much, and the men constructing them are getting right down to inches. Six inches added to a building may require an additional expense of $1,500. That is what cuts down the air spaces. I do not see why they cannot ventilate a vault, although we have no laws to that effect.

Mr. Currie: I would like to ask Mr. Eurich a question or so.

First: What is the object of ventilation or air spaces in the building, into the crypts or anywhere else? Is it really necessary that we provide ventilation?

As to the size of the openings or the air spaces, Mr. Eurich contends that if those spaces are large enough we will have no condensation, or at least if we have any, the condensation will be immediately absorbed, so soon as to do no harm, by the current of air flowing through the building. I want to state in that connection from our experience again that we had large spaces in the structure I referrred to, in the irregular space, averaging not less than 4 inches around the wall. I pointed out to Burnham & Company, of Chicago, this fact, which is familiar to you all, that along the lakes and in places on the seashore, under certain conditions of the atmosphere and temperature, at certain seasons of the year, you will find on the north side of any structure of this nature, considerable moisture. In our climate it takes the form of hoar frost in certain conditions; but usually in the morning you will see the building all wet on the outside from top to bottom. That building surely is properly ventilated; the space around is surely large enough to absorb condensation as quickly as it forms; but there it is. The point is, it does not appear in the north, south and west, simply because the air under the influence of the sun absorbs that moisture perhaps as rapidly as it is being formed, so it does not appear—that is all.

Imagine then the interior space of a building instead of the exterior where the rays of the sun cannot affect the temperature, and the probability is, and it is safe to assume from our experience, that moisture is not absorbed by the air, but passes into the structure and the joints.

The question then is this: Has Mr. Eurich observed those conditions in Detroit, and what is the object of ventilation, and would it not be just as well in view of the circumstances to cut it off? In some sections of the country it makes no difference unless you have considerable frost with it. The only effect will be a little discoloration, but it will not disintegrate the construction of the building.

Mr. Eurich: The object would be to

neutralize it as much as possible; but as we cannot have heat to counteract it, we must counteract it with currents of air, and I am confident that the building with air spaces will stand the ravages of time better than the one having no air spaces, or even dead air spaces; where you have no chance to neutralize any moisture that will appear. I am satisfied that with dead air spaces we will have condensation on the interior any way.

Mr. Allen: I would like to ask if any cemetery superintendent here has had any experience in regard to solid wall mausoleums; that is, ventilated mausoleums with walls built of one solid stone, perhaps 18 feet long and 10 or 11 feet wide—the whole side of the building? The interior where it is open is polished, and what has been the result in regard to condensation in cases of that kind?

Mr. P. W. Goodwin: We have a mausoleum in our cemetery composed of two stones, with no marble lining. The inside of the granite composes the inside finish of the room; also the outside granite composes the outside finish. There was no ventilation. The crypts were all underneath the ground in catacombs, with a descending, winding stairway. The building stands 11 feet above the ground from the inside, with a dome roof. It stood there one winter and the next spring it commenced to show spots all over the roof and on the sidewalls and it completely mildewed until it was practically beyond repair, and today the mildew spots cannot be entirely cleaned, even by the most modern and experienced cleaners. It kept getting worse, and after two years they got granite men there and put a system of ventilation at the top and bottom and through the doors. Since that time no mildew has appeared.

Mr. Gossard: I do not know anything about this mausoleum business, but I want to tell you about one we have in our cemetery. A one-piece stone has been mentioned. We have one of that kind 26 feet long and 13 feet 10 inches wide. The sides are each of one piece; the rear end is of one piece; there is a window in the rear end, but it is cut out of solid granite. The front is in three pieces, with a little vestibule in front. Four columns each in one piece hold up the ceiling stone. The ceiling stone is in one piece of the size that I mentioned. The weight is 35 tons. The ceiling is polished, and the interior is of rough stone, probably 12 or more inches thick. That is lined with white marble and wired with copper wire. The floor is in one piece.

There is ventilation between each of those stones. The floor is composed of two stones, one on top of the other, runing the full length, that is, the top stone is in two pieces; but it extends under the front part; so that the steps are held in place, and the ventilators are 6 or 8 inches long and probably two inches thick, that go from side to side between each one of these stones. The roof is in three pieces. There are two pieces at the lower part and a flange cut on the upper part, so that the joint is probably an inch and a half from where the top stone sets; so that there is no joint exposed, and the end stone is cut with a square column, and it goes in like a piece of furniture; the side stones go into that end stone.

We have never found any moisture in that mausoleum and no condensation at all.

TAYNTOR MAUSOLEUM ROOF PATENT CASE.

On the appeal from the decree in equity of the U. S. Circuit Court for the Southern District of New York, holding invalid U. S. Letters Patent No. 722,392 granted to Chas. E. Tayntor, Mar. 10, 1903, for an improvement in roofs for mausoleums, Judge Coxe after an introduction quotes the ruling of the Circuit Court Judge on the original suit, which was as follows:

In my opinion the invention asserted to reside in this patent (in so far as this suit is concerned) consists solely in so cutting away the major portion of the exposed surface of the two side roof stones as to leave a rib or ridge along its upper outer edge and then resting the capstone lips upon said ridges or ribs instead of upon the plane surface of the roof stones.

This construction elevates the exposed line of joinder between capstone and roof stones above the general level of the sloping roof just as much as the roof stones are cut away to form said ribs or ridges: in practice from ¾ of an inch to 1¼ inches.

Judge Coxe then proceeds with his discussion and ruling, and says:

The longitudinal joints are thus raised above the general slope of the roof the distance that the side roof stones have been cut away to form the ribs. If, therefore, rain should be driven horizontally by the wind the water, in order to reach the inside of the tomb, must be driven not only up the slanting roof-stone but also up the vertical wall of the rib. Whatever novelty there may be in the combination of the claim must be found in these raised joints or seams. It cannot be pretended that, with these omitted, there is anything patentable in the Tayntor structure, as exemplified by the claim in controversy. We do not understand that the combination can be saved by reason of the fact that it includes pediments as one of its elements. The person who first conceived the raised joint may be entitled to rank as an inventor, but it required no exercise of the inventive faculty to apply the old joint to the roof of a structure having pediments or any other especial characteristic, provided no new result is produced by such application. The raised joints produce the same results whether there are pediments at the ends of the building or not. There is nothing novel in the pediments, so far as the second claim is concerned. It is not limited to any particular variety of pediment. A roof having the other elements of the claim and pediments of any construction, would anticipate. The special features of the pediments of the Tayntor structure are covered by claims 7 to 10, inclusive. The raised joints, which are the features upon which the claim must stand or fall. are clearly shown in the Black and Feigenspan tombs. The general construction of these edifices differs from that of the Tayntor tomb; the pitch of the roof-stones is less and there are many minor differences of construction, but the raised joints are clearly shown in each, operating precisely as in the tomb of the patent. In both the prior structures wind-driven rain will necessarily be forced up the slanting roof not only, but up the vertical ribs as well, in order to reach the seams. The differences in the slant of the roofs, the height of the ribs and the width of the lips are differences of degree only. It cannot be successfully maintained that the pitch of the roof, or any of the differences pointed out between the prior structures and the structure of the patent, are of the essence of the alleged invention. The raised joint performs its function as well in the one case as in the other, though evidently the necessity for such a joint would be minimized in high-pitched roofs like those of the Black and Feigenspan structures. Surely it did not require an exercise of the inventive faculty to place the old raised joints of Black upon the Goetchius tomb. No new result was accomplished. The plain simplicity and beauty of the defendant's tomb is not due to anything found in the second claim of the patent. The patent is not for a design.

The decree of the Circuit Court deciding that this feature was not patentable was affirmed with costs.

The above decision refers to one of Mr. Tayntor's earlier patents, and did not affect later improvements which he patented.

OUR COSTLIEST PRIVATE MAUSOLEUMS.

Could you give me the names, sizes and approximate cost of the five or six largest mausoleums in this country, or whatever part of this information you may have? We have all the editions of the Monumental News for the past ten years or more, and if you could give us the month and year in which the largest tombs may have been described we would appreciate it very much.—M. J., Mo.

The Monumental News has illustrated and described in years past nearly all of the largest and most expensive private mausoleums that have been erected in this country, but they have appeared at such long intervals it would be impossible to refer you to all of them.

Following is, however, a summary of the leading statistics about a number of the costliest mausoleums that have been erected in this country:

Gates, Woodlawn Cemetery, New York City; erected by Stone, Gould & Farrington; cut by N. Pelaggi & Co., Northfield, Vt.; 54x35 feet; cost $125,000.

Ehret, Woodlawn Cemetery, New York

City; cost $100,000; approximate ground dimensions, 37x37 feet.

William Bradley, Woodlawn Cemetery, New York City; erected by Harrison Granite Co., New York City; cut by Jones Bros. Co., Barre, Vt.; cost $100,000; dimensions, 35-8x46-8x21-0 high.

Chisholm, Portland, Me.; erected by Flint Granite Co., New York City; cut by Jones Bros. Co., Barre, Vt.; cost $92,000; dimensions, 39-8x17-10x22-0 high.

Anthony N. Brady, Albany, N. Y.; erected by Flint Granite Co., New York City; cost $85,000; 43-0x25-0x20-0 high.

Edward E. McCall, Albany, N. Y.; erected by Flint Granite Co., New York City; cost $67,000; dimensions, 42-6x20-0x24-6 high.

Poth, West Laurel Hill Cemetery, Philadelphia; cost about $50,000; 27-0x34-6 in ground dimensions.

In Homewood Cemetery, Pittsburgh; "Eaton," 30-0x24-7; cost $26,000; "Jennings," 29-6x16-10; cost $20,000; "Pitcairn," 30-0x15-0; cost $22,000.

H. Messchert, West Laurel Hill, Philadelphia; cost $25,000; dimensions, 16-6x 23-0.

Spring Grove Cemetery, Cincinnati, O.; "Groesbeck," 25x30 feet; cost $25,000; "Fleischmann," 25x35 feet; cost $35,000; "McDonald," 20x30 feet; cost $30,000.

Andrews mausoleum, Lake View Cemetery, Cleveland, O.; erected by C. E. Taynton Granite Co., New York City; cost $65,000; dimensions, 25-0x38-0x18-3; cut by Jones Bros. Co., Barre, Vt.

In Graceland Cemetery, Chicago: Potter Palmer, 26x40 feet; Martin Ryerson, 17x24 feet; "Wilke," 15x15 feet.

E. H. Gary mausoleum, Wheaton, Ill.; cut by Jones Bros. Co., Barre, Vt., for Charles G. Blake & Co., Chicago.

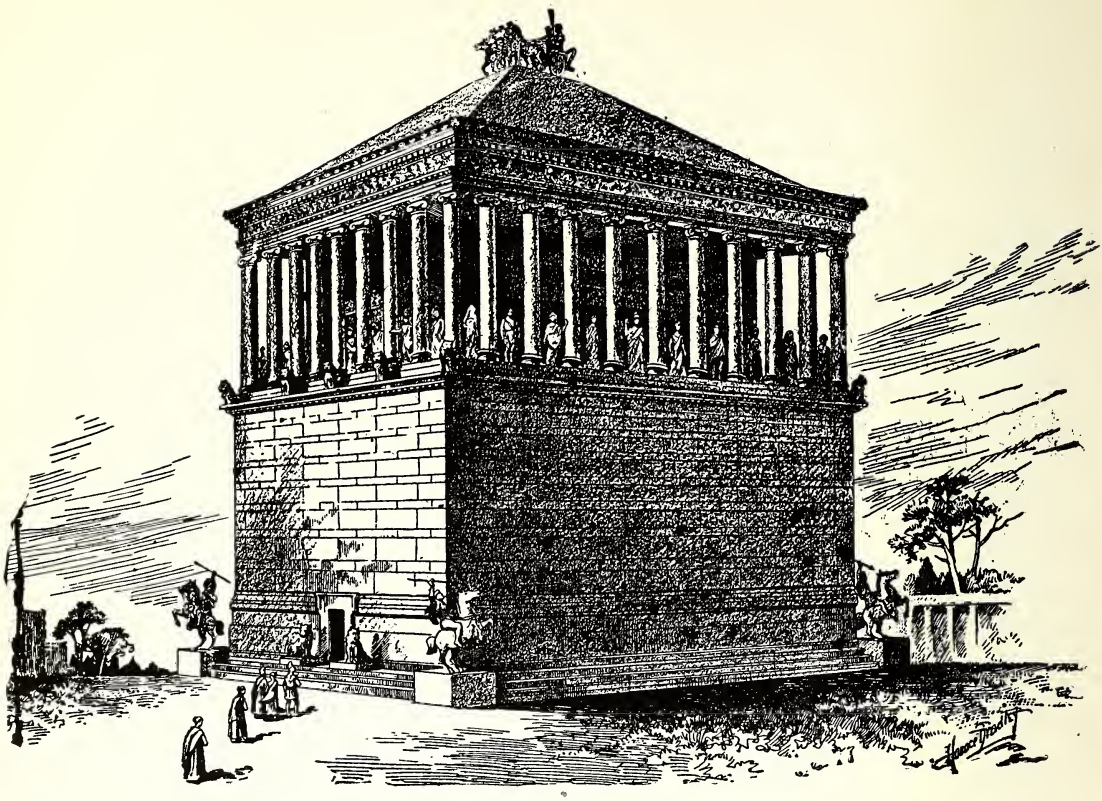
"Krueger," Newark, N. J.; cut by Jones Bros. Co. for George Brown, Newark, N. J.

THE TOMB OF MAUSOLUS.

King Mausolus, whose lifeless form is supposed to have rested for 2,000 years in the magnificent tomb illustrated above, is credited with having conceived the idea of erecting such edifices, hence the name mausoleum. His, at least, was one of the few great works of the ancient world and was commenced prior to his death, in 353 B. C. After his death Artimisia, his wife, employed the most skillful architects and sculptors and continued the work. Two years later she was removed by death, leaving the monument unfinished and the vast sums of money required to complete the mausoleum not provided for. History tells us that the architects and sculptors resolved to complete the work without further remuneration than the honor and satisfaction of the success they had achieved.

Mr. C. T. Newton, keeper of the Greek and Roman antiquities in the British museum, has followed the description which Pliny left, and guided by his discoveries, concludes that the mausoleum was composed of a basement, 65 feet in height; a peristyle, or enclosure of columns, within which stood a structure of richly decorated solid walls, 37 feet in height; a pyramid, 25 feet in height, and upon the pyramid or upon a pedestal that rose therefrom, a four horse chariot, in which stood a female figure, that may have been intended for his favorite deity or for his faithful spouse. The entire height was about 140 feet, and may have been considerably more. The length of the basement was 114 feet and its width 92 feet.

The mausoleum has received constant mention from the time of Strabo to the twelfth century of the Christian era. Gregory of Naziansen, writing in the fourth century, notes that its sanctity had evidently not been violated. Eustathius, writing in the twelfth century, in his commentary upon the Iliad, says: "It was, and is a wonder." Between this and the following century, what man had thus far spared succumbed to some convulsion of nature, for in 1402, when the Knights of St. John took possession of the site for a stronghold against the Saracens, the mausoleum was no more, and its dismembered fragments served as materials of the new fortification. The work of destruction was not complete, however, until 1522, when the Sultan, Solyman, seeming to threaten Rhodes, the Grand Master, sent the Knights again to the site of the



TOMB OF MAUSOLUS, FROM WHICH WORD "MAUSOLEUM" WAS DERIVED.

city of Mausolus to further strengthen the Castle of St. Peter. Then the stones of the base of the Mausoleum were, for the first time, disturbed and the sepulchral chamber and the sarcophagus seen again by men.

THE MONUMENT DEALER'S LIBRARY.

A completely equipped monument firm ought to have in its library nearly all the important works published that have anything to do with monumental art or monumental materials. We should recommend the purchase of as many as possible of the following list of books:

"The Monument Dealers' Manual," published by Monumental News, 536 South Clark St., Chicago; price, $5.

"Building and Ornamental Stones," Bulletin No. 4 of Wisconsin Geological and Natural History Survey.

"The Stone Industry for 1912," U. S. Geological Survey.

"The Granite of Vermont," Bulletin 404 of the U. S. Geological Survey.

"Reports of George H. Perkins," Vermont State Geologist, 1913-1915.

"Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island," Bulletin 453 of U. S. Geological Survey.

"Building and Ornamental Stones of North Carolina," Bulletin No. 2 of North Carolina Geological Survey.

Merrill's "Stones for Buildings and Decoration," published by John Wiley & Sons, New York City, N. Y.

"Important Symbols," by Adelaide S. Hall, published by Bates & Guild, Boston.

"Principles of Greek Art," by Percy Gardner, published by the Macmillan Co., New York.

"Ancient Sepulchral Monuments," by Brindley & Weatherly, published by the Stone Trades Journal, London, England.

"Egyptian Obelisks," by Henry H. Gorringe, published by the author at 32 Waverly Place, New York, N. Y.

"Modern American Sculpture," a collection of plates of the leading American sculptures; published by Paul Wenzel, 31 East 12th St., New York.

"History of Sepulchral Cross Slabs," by K. E. Styan, published by Bembrose & Sons, London, England.

"History of Ornament," by A. D. F. Hamlin, published by The Century Co., New York.

"The Care of Ancient Monuments," by G. B. Brown, published by the Macmillan Co., New York, N. Y.

"Handbook of Drawing," by W. Walker, published by Chas. Scribner's Sons, New York.

"Memorials and Monuments," by Lawrence Weaver, sold by Chas. Scribner's Sons, New York.

"Renascence Tombs of Rome," by G. S. Davis, published by E. P. Dutton & Co., New York City.

"The Cross in Tradition, History and Art," by Rev. W. W. Seymour, published by G. P. Putnam's Sons, New York, N. Y.

"Freehand Perspective and Sketching," by Dora Miriam Norton, published by the author at Pratt Institute, Brooklyn, N. Y.

"Six Lectures on Architecture," published by the University of Chicago Press, Chicago, Ill.

"The Enjoyment of Architecture," by T. F. Hamlin, published by Duffield & Co., New York, N. Y.

"Memorial Art, Ancient and Modern," published by Harry A. Bliss, Buffalo, N. Y.

"Sculptured Crosses," published by Granite, Marble and Bronze, Boston, Mass.

"Nash's Expeditious Measurer," published by Baker & Taylor Co., 354 Fourth Ave., New York.

"Complete Granite Estimates," published by Chas. H. Gall, 127 North Dearborn St., Chicago.

"Barre Granite Estimating Book," published by Granite Manufacturers' Association, Barre, Vt.

"George's Book of Wisconsin Granite Estimates," published by George Brothers Co., Dixon, Ill.

"Essentials of Composition as Applied to Art," published by the Macmillan Co., New York, N. Y.

"Letters and Lettering," by Frank C. Brown, published by Bates & Guild, Boston, Mass.

Two standard works of reference on ornament that are very comprehensive are the following:

"Dictionary of Architecture and Building," by Russell Sturgis, in several volumes, published by the Macmillan Co., New York; "Handbook of Ornament," by F. S. Meyer, published by Bruno Hessling, New York.

Some other general descriptive works on ornament, profusely illustrated with every style of decorative ornament, are the following:

"Historic Ornament," by James Ward, Vol. I, published by Chapman & Hall, London.

"The Principles of Ornament," by James Ward, imported by Chas. Scribner's Sons, New York City.

"The Planning of Ornament," by Lewis F. Day, published by B. T. Batsford, 94 High Holborn, London.

Works describing the technical processes used in modeling and sculpture are the following:

"Plaster Casts and How They Are Made," published by Wm. T. Comstock, New York City.

"Technique of Sculpture," by William Ordway Partridge, published by Ginn & Co., Boston, Mass.

"Modeling and Sculpture," a description of the various methods and processes, by Albert Toft, published by Seeley & Co., 38 Great Russel St., London.

General descriptive, historical and critical works on sculpture that are very informative and interesting are the following:

"Handbook of Modern French Sculpture," by S. Cady Eaton, published by Dodd, Mead & Co., New York City.

"How to Judge Architecture," by Russell Sturgis, published by Baker & Taylor Co., 354 Fourth Ave., New York, N. Y.

"The Appreciation of Sculpture," by Russell Sturgis, published by Baker & Taylor Co., 354 Fourth Ave., New York, N. Y.

"Famous Sculptures," described by great writers, edited by Esther Singleton, published by Dodd, Mead & Co., New York, N. Y.

"History of American Sculpture," by Lorado Taft, published by the Macmillan Co., New York, N. Y.

"American Masters of Sculpture," by Chas. H. Caffin, published by Doubleday, Page & Co., Garden City, N. Y.

"European Architecture"; plates of architectural decorations on European buildings; published in 1892 by Smith & Packard, Medinah Bldg., Chicago.

"The Five Orders of Architecture," by James T. Ball; detailed working drawings of the Five Orders in large plates; published by Wm. T. Comstock, 23 Warren St., New York.

No doubt many of these works may be examined at public libraries before buying them and probably the best way to take up the purchase of them would be through one of the large book stores in your city or through McClurg's of Chicago or Brentano's of New York.

The Government publications, of course, can be obtained through the United States Geological Survey at a very nominal cost.

BOOKS ON DRAWING AND LETTERING.

"Letters and Lettering," by Frank Chouteau Brown, price $2, published by Bates & Guild, 144 Congress St., Boston, Mass.

"Simplified Mechanical Perspective," by F. F. Frederick, price 75 cents, published by Wm. T. Comstock, New York, N. Y.

"Book of Alphabets for Stone Cutters and Draftsmen," published by Spon & Chamberlain, 12 Cortlandt St., New York. Price, 25 cents.

"Lettering for Draftsmen, Engineers and Students," published by D. Van Nostrand Co., 23 Murray St., New York City. Price, $1.

"Modern Alphabets, Plain and Ornamental," published by the William T. Comstock Co., 23 Warren St., New York City. Price, $1.

"Practical Lettering," published by G. E. Strechert, 151 West 25th St., New York City. Price, 60 cents.

"Modern Lettering: Artistic and Practical," published by Wm. T. Comstock Co., 23 Warren St., New York City. Price, $2.

"Handbook on Linear Perspective," published by Ginn & Co., 388 Wabash Ave., Chicago, Ill. Price, $1.25.

THE DECORATION OF MOULDINGS.

Of all the architectural elements employed in our line of work, none seem to hold a more important position for ornamentation than that of mouldings. The fact of this assertion can be readily felt by attempting to ornament one of the simplest of monuments, that of the plainest sarcophagus. All designs save those of a pyramid, obelisk and occasional rock-face work which are not architectural in a sense are subject to become freak designs or originalities in themselves without the aid of mouldings, no matter what name or style be given to them. Apart from the proper use and correct distribution of mouldings the ornamentation applied to them is a matter equally as important; that is to say, an ivy or floral design on a Greek Echinus or a Guilloche pattern on an Egyptian bead would be entirely inconsistent as to position, shape and style of architecture. Considering what may be seen in our cemeteries of errors similar to the one just instanced, a little reading or study of good architectural books would greatly benefit the designer.

The first and smallest of all mouldings is the Fillet and too small to decorate except when widened, which then becomes a Band.

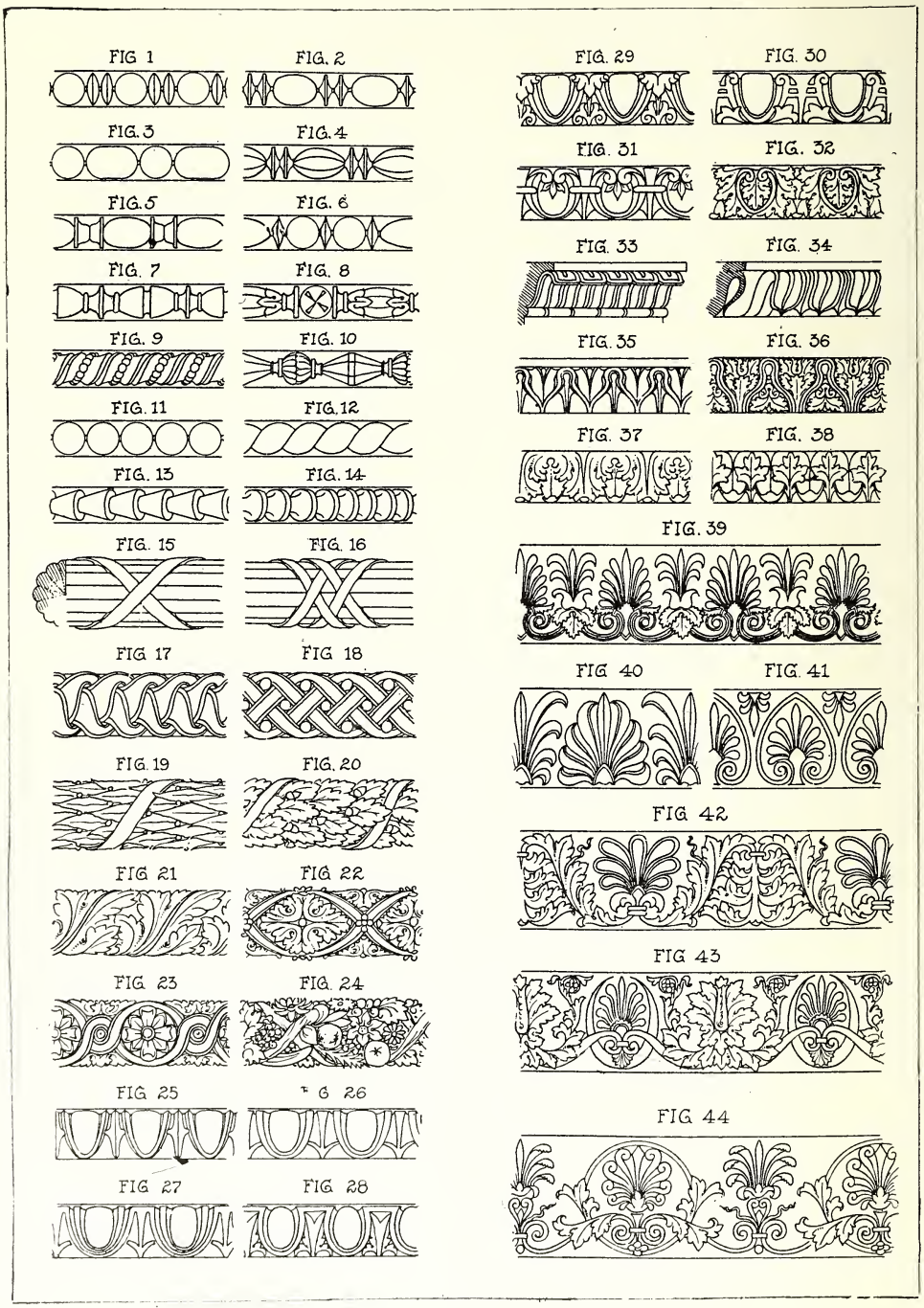
The next larger moulding is a Bead, which at the beginning was used very frequently by both the Greeks and Romans, who in some instances enlarged it and then gave it the name of a Torus. Figures 1 and 2 show the Greek decoration of the Bead. Figures 3, 4, 5 and 6, the Roman. Figures 7, 8, 9 and 10 the Renascence, and figures 11, 12, 13 and 14 the Romanesque, Byzantine and Gothic.

The Torus in the classic orders appears mostly on columns and pilasters and instead of being decorated with pearls, discs and spindles this more important moulding is enriched with what seems to be a bundle of rods around which ribbons are twisted at suitable places, Figures 15 and 16; a decoration which is consistent with the theory of this moulding, that of denoting bond and strength. It is sometimes, too, surrounded with a plaited or net work, Figures 17 and 18. In the Renascence, Mediaeval and Gothic styles the Torus is used mostly on doorway, windows and string-courses and is still richer in decoration by clothing it with various designs and systems shown in Figures 19, 20, 21, 22 and 23. Some examples are most exquisite and too numerous to illustrate, they being decorated with almost every conceivable design, water-leaves and artificial leaves with serrated margins. Laurel, oak, ivy, holly and acanthus all make good elements to use. As in the case of clustered fruit, ribbons are twined spirally at suitable places which appear to hold the elements together as in Figure 24, which is taken from the Louvre, in Paris.

Figure 25 shows the first decoration of the Ovolo or quarter-round moulding. In Greek work, of which the figure is an example, the moulding is known as the Echinus and the ornament is the well-known egg and dart pattern, from which all the more or less misunderstood varieties have, in course of time, been derived. To contrast this with the following varieties one may observe the Greek love for simplicity and refinement and can hardly say it is improved upon. Figures 26 and 27 are Roman examples showing slight variations. The egg and dart ornament harmonizes well with the support and weight the moulding possesses and is nicely adapted to its position. It also has a very decorative feature as a bordering member on panels. Figures 28, 29, 30 and 31 are developments which can be used in almost any other style than the Classic. In Figure 32 can be seen how the egg or curved surfaces of the leaves have been covered with independent ornamentation, defying their origin.

The origin of the Cyma-reversa received its form from the manner in which it was decorated. Its prototype is the bird's-beak moulding which is so frequently employed on all Grecian Doric structures; a row of leaves, growing upwards, supports the weight above it and is bent outwards by its pressure, Figure 33, which only occurs partially. To still bend the leaves outward and down towards their lower ends we thus obtain the moulding having its double curvature, Figure 34. A false conception, which regarded the leaf-shape merely as a geometrical element, afterwards gave rise to the corrupt forms of the late Greek and Roman styles, in Figures 35 and 36. The size of this particular moulding does not afford the space for variations as most others and in some instances it is too small to decorate, which is then termed a Cymatium. For this rea-

son the succeeding styles have invariably copied the original or Antique. In the Renascence the simple water-leaf was replaced by more richly serrated ones like

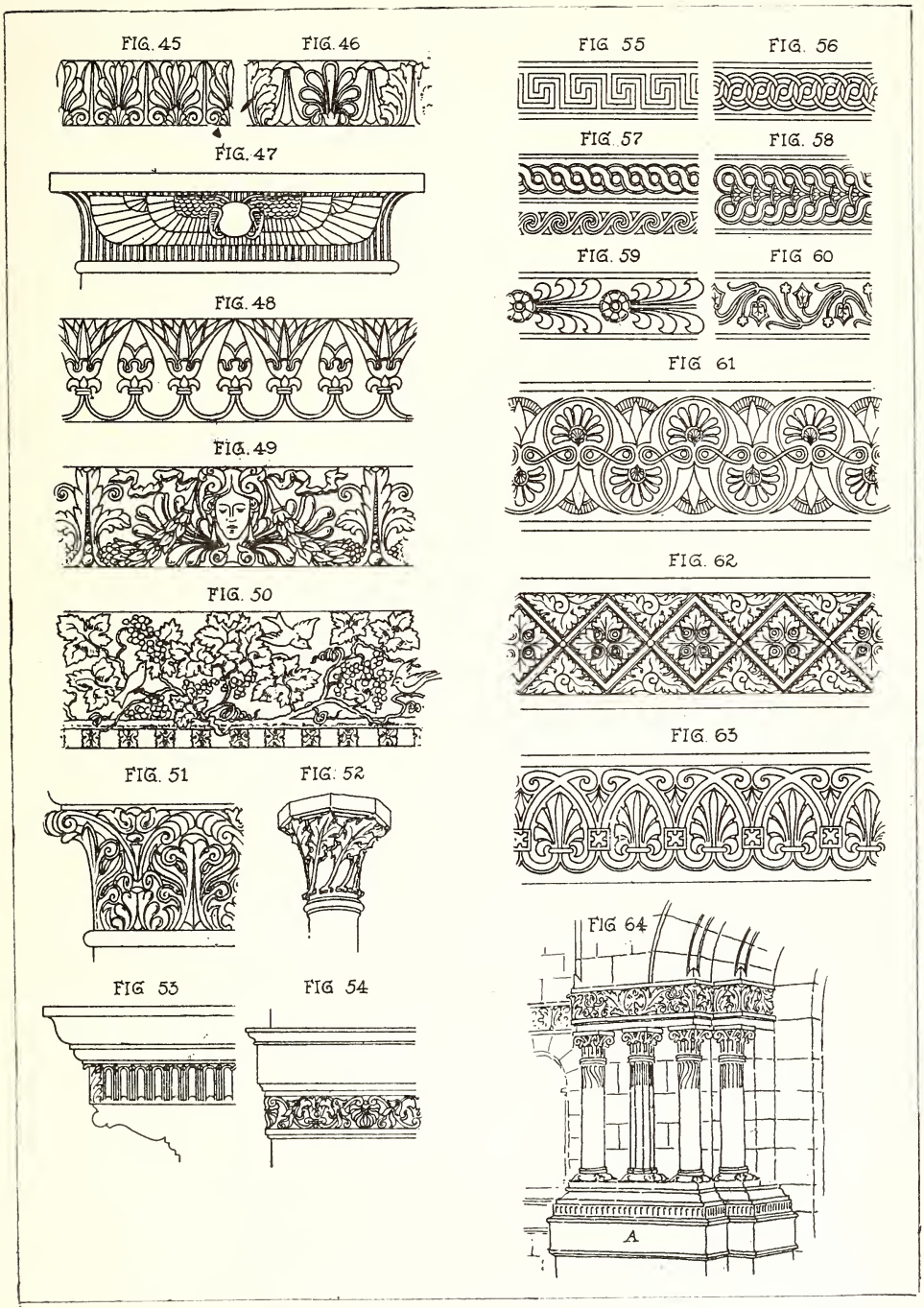


concluding member serving as a gutter. It is composed of two arcs curving inward and outward respectively. It is the only moulding on which to place the most beautiful of mould decorations. The double curve is a most fitting position to display either the natural lines in all foliage or artificial ones. The first decorations were those of the Grecian honey-suckle

the artificial leaf, shown in Figures 37 and 38.

The Cyma-recta is the topmost and largest of mouldings, so to speak; the theory of which is supposed to be to use it as a

and palmette with leaves either connected or disconnected, Figures 39, 40 and 41, but mostly with lily cups between, as shown in the first figure. The Romans employed



serves as a concluding member. Its section is concave and can be made either small or large. In the classic styles it is mostly found under a fillet, and therefore usually

mostly the acanthus leaf, Figure 42. Both Renascence and Modern art follow the tradition of the Antique, but give the palmette a richer form, Figures 43 and 44.

The Cavetto, like the Cyma-recta, also small. It is only ornamented when made large, but does not receive the same attention as the Cyma-recta, and in many instances, regardless of its size, it is still left plain. Figures 45 and 46 show the

treatment of it in the Classic, which is nothing more than an infringement upon the decoration of the Cyma-recta. All other styles made extensive use of the Cavetto and found it a very important moulding in the way of decorating, and especially in the joining of two surfaces where the desire is to have them become tangential. Judging from the accompanying illustrations one would think it was the most important. Take, for instance, the Egyptians. They found nothing that looked more suitable or that could be adapted to that particular place so as to give the walls of their structures the appearance of completeness; that of carrying and terminating the inclined line to a proper finish. In this moulding they put their most important ornament, that of the winged globe or sign of Horus, Figure 47. Figure 48 shows the treatment of the lotus plant in this moulding. In the Renascence we find the Cavetto more elaborate (Figure 49), but in Gothic work may be seen its supreme position over other mouldings and the height of its embellishment (Figures 50 and 51), not only as a decorated moulding, but its line serves as a harmonious division between piers and clustered columns. The very line on some of the Gothic capitals is nothing more than a decorated Cavetto (Figure 52). The plain moulding itself is frequently used to soften the union of a wall and stylabate; likewise with wall and cornice. In the former case, where it is used at the base of a building or monument, it is then termed a Scotia; simply the Cavetto inverted. Windows and doors cannot be of a true Gothic character without this line of the Cavetto. This completes the rudimentary decoration of mouldings with the exception of the Band.

The Band can hardly be called a moulding, yet in many cases it is used to serve the same purpose and sometimes comes into direct union with other mouldings. It is of one flat surface or face, and can be projected or raised any distance from the body or ground upon which it is cut, according to what it is going to serve or the effect one wishes to obtain. In designing a monument or mausoleum or a plain sarcophagus where the different surfaces have to be divided and subdivided into panels or zones, the importance and value of the Band is at once realized and appreciated, and in many instances it can be employed where no other moulding will answer. In the Classic orders the Corona is sometimes ornamented with a Band design (Figure 53), and in some rare instances a Band design can be seen on the architrave of buildings. Figure 54 is the design used on the architrave of the Temple of Jupiter Stator at Rome. Most commonly in Antique we find the Band used more for interior decoration on walls and in mosaic floors. Figures 55, 56, 57, 58, 59, 60 and 61 show the designs mostly adapted for the Classic treatment of Bands. With the exception of the fret and simple scroll, the arrangement of the elements are known as Link-borders, so termed because the transversely-growing foliage or design is connected together by scrolls, loops and hooks, which serve the purpose like the links in a chain. All Band designs should possess this one strong feature. Rather different is the Band decoration in this particular respect from the Cyma-recta, where each element may be detached or separated one from another. Like the Cavetto, the Band in all the subsequent styles of architecture became prominent, especially in Romanesque and Late Gothic, where it developed to a great size and was elaborately decorated (Figures 62 and 63). Sometimes the large ones were left plain, but only when used on the lower part of the building, and came under the term of belting, as shown at "A" in Figure 64.

The Link border is generally composed of identical details symmetrically repeated, and its forerunner is seen in the connected lily and pomegranate of the Assyrian style. Unsymmetrical and naturalistic forms should be avoided. A good decorated Band in some instances will serve better and improve the appearance of an object more than any combination of mouldings. Again, the proper decoration of mouldings in a certain combination or order is of vital importance regarding the size and weight of each member and the proportion of the object on which they rest, and sometimes, too, a beautiful profile is entirely ruined by some incompetent designer by causing a big bunch of ugly leaves to be carved on the corner of a monument, an instance which is so commonly met with in our line of work.

FRANKLIN L. NAYLOR.

A MOVING GRANITE BALL SUR MOUNTING A MONUMENT.

In the principal cemetery of Marion, Ohio, there is a monument which has attracted a great deal of attention. It consists of a large stone ball, 36 inches in diameter, resting upon a heavy pedestal. This ball is slowly turning upon its base, revolving about a horizontal axis in a direction from north to south, presumably by the action of the sun's rays.

The monument was erected a number of years ago by C. B. Merchant, a local banker, but it was not known that it was turning until the spring of 1904, when the cemetery employes noticed that it had apparently shifted a little. Since that time it has been watched and measured repeatedly, and it is established beyond question that the stone is turning continually.

The ball was never securely fastened to the base, but an unpolished spot was set in a socket, and it was supposed that the friction of the two rough surfaces would be sufficient to prevent any displacement. At the present time, however, the rough spot is nearly half-way to the top on the north side, and has moved over five inches. The ball weighs 4,200 pounds.

A number of theories have been advanced to account for the cause of this natural phenomenon. State Geologist Edward Orton, Jr., in a letter to a member of the cemetery association, says that the rotary movement is probably due to two causes. First, the ball becomes more heated than the heavy base, and consequently expands more, giving rise to a slight creeping. The ensuing contraction might not be sufficient to take up the displacement caused by the heat in the earlier part of the day.

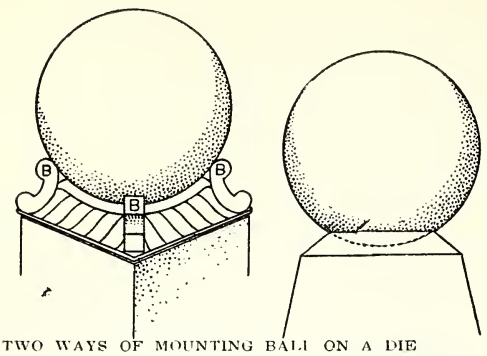
Secondly, we may regard the circumference of the sphere as lengthening out on one side, and giving rise to a pulling stress between the ball and base upon which it rests.

Prof. Becker, one of the head physicists of the Geological Survey, and Prof. Gilbert, who is probably the most prominent geologist in the Survey, have been consulted upon this question, but without very satisfactory results. Both were uncertain as to the cause of the rotation of the sphere, save that there could be no doubt that it is attributable to the action of the sun's rays. Prof. Becker said that if the rotation were from south to north, instead of being, as stated by our correspondent, from north to south, he could more easily understand the case, for then expansion of the sphere itself would be on the south side chiefly, so that leverage would be applied on that side, which might raise the ball there, causing it to slip downward correspondingly on the north side. Prof. Gilbert suggested that there might be a difference between the cup-shaped socket and the sphere, with a correspondingly imperfect fit and unequal friction on the two sides.

There is a large evergreen tree not far from the monument, and apparently directly to the south of it. It has been suggested that the monument is thus partly shaded at times, or for a portion of the day, and that there is some connection between this fact and the rotation. At present, despite all these theories, there seems to be no satisfactory explanation, and the phenomenon will probably remain unexplained until it has been under close scientific observation for a lengthy period of time.

Revolving granite balls surmounting monuments are also reported from Huron, S. D., and Cohasset, Mass., and Albert Richards, of Quincy, Mass., suggests a very plausible explanation of the phenomenon, and a very practical remedy for the difficulty, which it will be well for monument makers to note for possible future use in work of this kind.

Mr. Richards writes: "Concerning turning balls on monuments, I should like to say that there is one in the cemetery at Cohasset, Mass. This monument was set about three years ago. I have already turned it back twice. It moves in the same direction as the one erected in Marion, O., i. e., from northwest to southeast. When my attention was first called to this I said it was the frost, and I still believe it. You will notice when winter comes there is water under the ball. This freezes and the expansion lifts the ball. In melting, the southeast side melts first and drops back on the die, losing a small fraction of an inch every time it freezes. When the side away from the sun melts it drops back, but does not get back as far as it was before freezing. This, it seems, is the best explanation, as there is another ball in this same cemetery that



TWO WAYS OF MOUNTING BALL ON A DIE

This ball on brackets clear of die will not turn

This ball in socket in die will turn in frosty weather

never moves, as it is set on brackets which allow no water to come in contact with the ball. You will notice all those that move set deep in the die and leading is not water tight. If the socket were filled with cement I think it would stay all right."

The diagrams shown herewith illustrate clearly Mr. Richards' explanation. One shows how these balls are commonly set in a socket in the top of the die. In the other the ball is raised from the die on brackets, B, so that the water may freeze and melt without touching the ball.

THE ORDERS OF ARCHITECTURE

The essential features in monumental designing, in fact the sources from which may be drawn both the inspiration and information absolutely necessary for use in the creation of artistic work in this line, are to be found in what are commonly understood as the "five orders of architecture." While old, they are ever new; and as constant accessions to the ranks of monumental artisans and students present themselves, such information is always opportune. Moreover, the plates given, prepared for architectural students in one of our great educational institutions, contain in themselves a fund of information in a practical and concise form, which will in many respects be found of great value at all times.

The first illustration gives in outline form the principles of the Doric order drawn to scale, with the proportions of the different members in terms of the diameter of the column at its base.

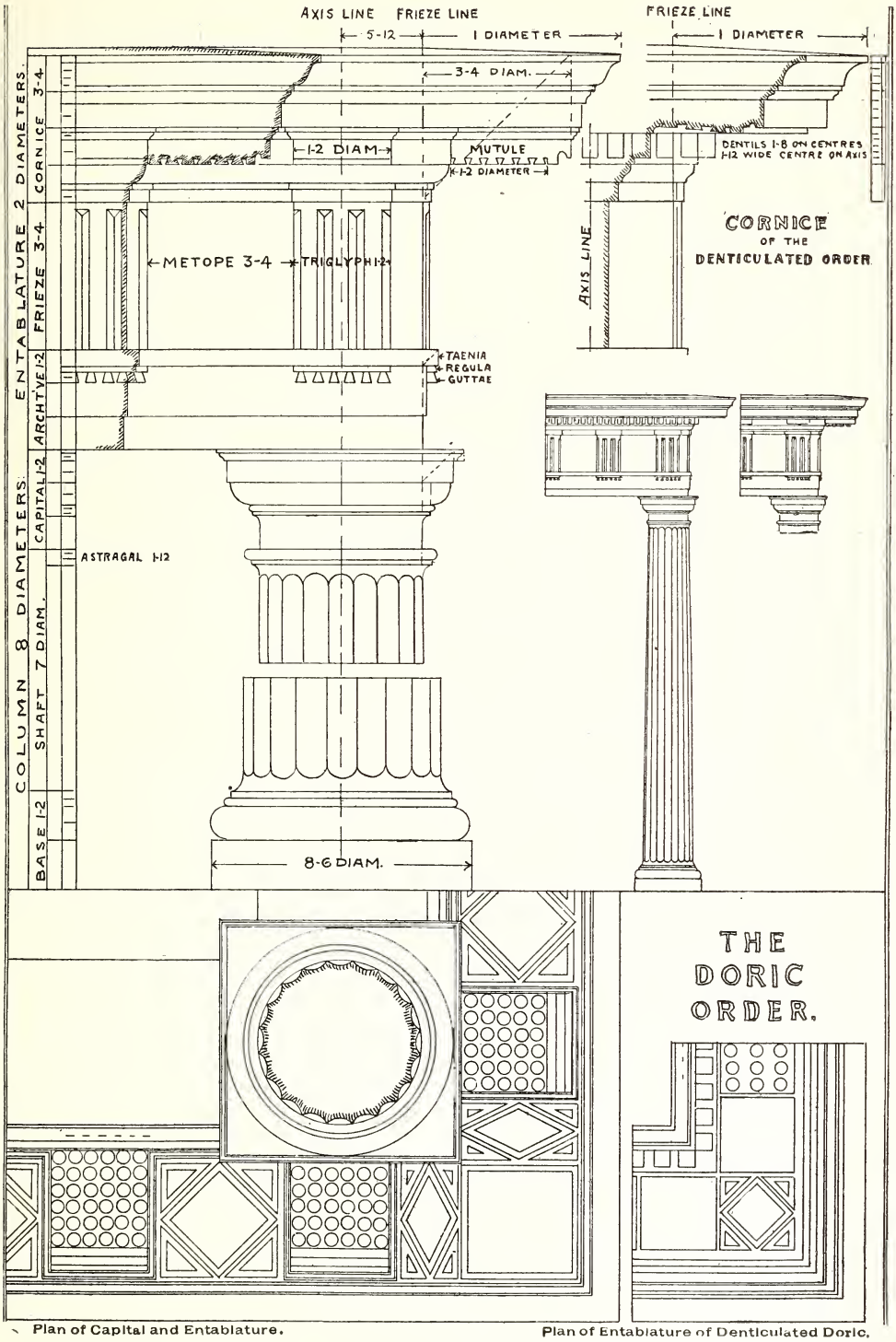
I. THE DORIC ORDER.

The origin of the Doric order, the first of the three Grecian orders, is not very well defined, Vetruvius himself, the great ancient architectural writer, giving several theories concerning it. But it attained a splendid development in the flourishing era of Greek art, and from the fact that the great majority of the Grecian temples, of which any ruins remain, were constructed in accordance with its principles, it must have been held in high esteem by the architects of those days. In general it is simple in character but combines with a sense of solidity a refinement of outline and proportion which, as carried out in the finest examples of Greek work gives it pre-eminence in architectural development. In detail it varied considerably, though simplicity always marked the Greek type. In pure Greek Doric examples there were no horizontal lines, a slight curvature being provided in all cases, and in the columnar arrangement the columns inclined slightly toward the center. To such a development did the Greeks carry their art in building, that design took into consideration even the optical effects which might tend to influence the precise proportions of the structure.

The Romans endeavored to adapt the principles of the Greek orders of architecture to their own, but the Roman character lacked the subtle refinement of the Greek, which is well exhibited by careful comparisons of the examples left us of both peoples.

The plate herewith gives the proportions of the several features of the order which can be readily estimated and understood therefrom, however varied. The Greek type had no base to the column, and the column varied in height from four to six diameters; the diagram gives greater length, which meets modern ideas. The shaft of the column diminishes in diameter from its base upwards in a slightly convex curve called the entasis. The usual number of flutes to the column is twenty, though this varies, and in one example there are none. The flutes are segmental, or semi-elliptical or eccentric in pattern, always meeting in an arris which follows the entasis up to the collar or astragal, where it finishes either with a straight or curved head.

The entablature, the third main feature of the order, also varies in height, well known examples giving from one and three-quarters to something over two diameters. The diagram gives two diameters, and it also gives the proportions of the



Plan of Capital and Entablature.

Plan of Entablature of Denticulated Doric.

various members of the entablature, such as architrave, frieze and cornice.

The architrave seldom carried any ornament beyond the regula and guttae shown on the diagram. The frieze is horizontally divided into triglyphs and metopes whose proportions and arrangement are shown. These in certain details varied, the metopes affording opportunity for sculptured decorative effects.

The crowning feature, the cornice, is given in detail and with a plan of its under surface, showing ornamentation.

GLOSSARY.

An explanation of some of the terms used on the diagram may be of service in the future.

Architrave—The lowest portion of the entablature, immediately resting on the column.

Astragal—The semi-circular bead or collar about the top of the column.

Capital—The head or upper portion of a column.

Cornice—The highest member of the entablature.

Dentils—The small square blocks or projections in the bed moldings of the cornice. Used only occasionally in the Doric order.

Frieze—The middle members of the entablature upon which sculptured adornment is much used.

Guttae—Ornaments to resemble drops, placed below the triglyphs in the Doric order.

Metope—The space between the triglyphs in the Doric order.

Mutule—A projecting block under the corona of the Doric cornice often made with a slope down towards the front and is usually worked as shown on plan of entablature in diagram.

Regula—A band below the taenia.

Taenia—The band or fillet of the architrave immediately below the frieze.

Triglyphs—An inseparable ornament of the order, repeated at equal intervals. Each triglyph consists of two entire channels separated by their interstices and two half channels at the sides.

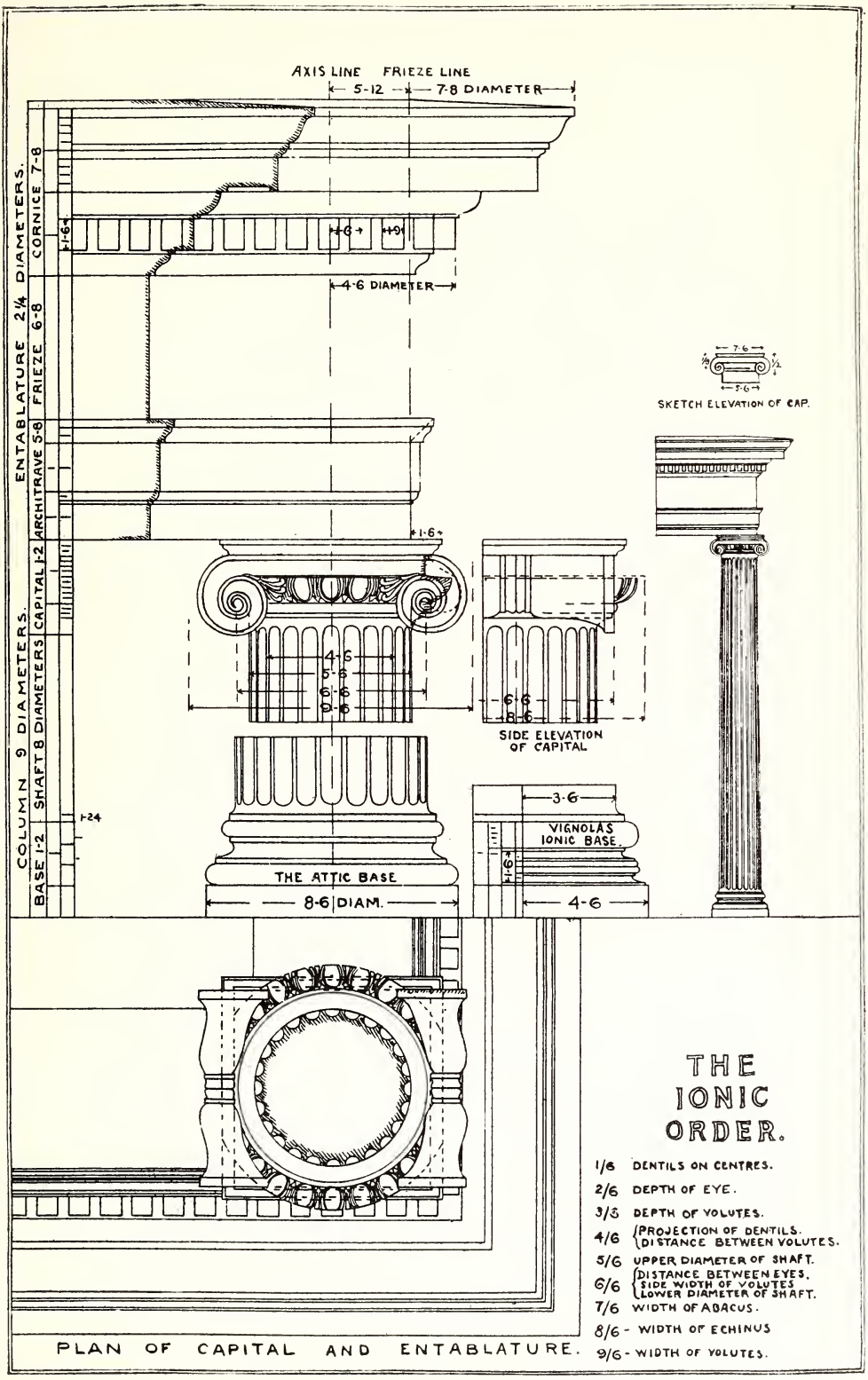
II. THE IONIC ORDER.

In the preceding matter the main features of the Doric order of architecture were graphically presented. That order was referred to as being distinctly Greek, and may be said to have been invented by them. The second of the three great antique orders is the Ionic, of which a plate is herewith given.

The origin of the Ionic order is more or less shrouded in the mists of antiquity, although it bears strong evidence of being derived from Asiatic sources; but it underwent the refining processes of Greek wisdom and taste and became an order under their influence whose proportions and lines give evidence of the clear insight of the Greek character of the time in the development of art and its adaptations. Vitruvius says that the building of a temple to Diana prompted the desire to find something new in the line of the beautiful in architecture, and that while the Doric column was designed after the proportions of a man, by the same methods they designed the Ionic column to represent the proportions and delicacy of the female figure. They made the shaft lighter, put a base to it of twisted cords, like a woman's sandals, made a capital with volutes, like her hair on each side of her face, and fluted the column to carry the idea of garments. The old writer adds: They invented the two kinds of columns, on one giving the naked simplicity of the man, and the other showing the delicacy and ornaments of the woman. The distinguishing mark of this order is the volutes of the capitals, which in the pure Ionic are designed alike on front and rear, and are connected on the sides by an ornamental scroll. The plan of the capital on the diagram shows this. On corner columns there are three volutes, the one on the external angle being placed diagonally. The shaft is cut with twenty-four flutes, separated by fillets which follow the entasis of the column. These flutings are nearly semi-elliptical in plan and finish at top and bottom in similar curves.

The base of the column in the ancient examples shows variation, and two examples are shown on diagram, but the Attic design is the most appropriate.

The most perfect examples of the Ionic order yet remaining are to be found on the Acropolis of Athens. The Erechtheum and the temple of the Wingless Victory display particularly the elaboration of ornament which had necessarily to be developed and applied to this graceful order. The so-called honeysuckle ornament embellishes the neckings of the columns of the Acropolis. Speaking of the neckings of the columns, the examples of the Acropolis are alone in this particular; it is an extension of the column above the terminal tops of the flutings, instead of carry-


AXIS LINE
FRIEZE LINE
5-12
7-8 DIAMETER
ENTABLATURE 2¼ DIAMETERS.
CORNICE 7-8
FRIEZE 6-8
ARCHITRAVE 5-8
CAPITAL 1-2
SHAFT 8 DIAMETERS
BASE 1-2
COLUMN 9 DIAMETERS.
1-6
1-9
4-6 DIAMETER
1-24
SKETCH ELEVATION OF CAP.
7-6
5-6
4-6
5-6
6-6
5-6
6-6
8-6
SIDE ELEVATION OF CAPITAL
3-6
VIGNOLA'S IONIC BASE
THE ATTIC BASE
8-6 DIAM.
4-6
PLAN OF CAPITAL AND ENTABLATURE.
THE IONIC ORDER.
1/6 DENTILS ON CENTRES.
2/6 DEPTH OF EYE.
3/3 DEPTH OF VOLUTES.
4/6 PROJECTION OF DENTILS. DISTANCE BETWEEN VOLUTES.
5/6 UPPER DIAMETER OF SHAFT.
6/6 DISTANCE BETWEEN EYES. SIDE WIDTH OF VOLUTES LOWER DIAMETER OF SHAFT.
7/6 WIDTH OF ABACUS.
8/6 - WIDTH OF ECHINUS
9/6 - WIDTH OF VOLUTES.

ing the latter up to the moldings which bed the volutes.

A much greater variety exists in the details of the Ionic order than in the Doric, and then again, in the matter of decoration the artistic fancy had more latitude, and ornament developed into gracefulness and appropriateness.

The Ionic order has found some expression in many cemetery memorials and examples of monumental design, and its graceful proportions and adaptability to ornamental details make it especially suggestive in this class of work.

The pediments of the ancient buildings constructed on the Ionic order are flatter than those of the Doric, in some cases the cornice with the base make an angle less than fourteen degrees. The distance in different examples also varies—in one example two diameters is the distance, in another three and one-sixth diameters.

GLOSSARY.

A continuation of the glossary given in the preceding pages explanatory of the technical terms often used will be good for reference.

Abacus—The upper part of the capital of a column.

Antifixae—Ornamental upright blocks placed at regular intervals on a cornice.

Cavetto—A simple concave molding, impending.

Echinus—An eccentrically curved molding. When cut it is carved into forms of eggs and darts.

Fascia—Bands. The vertical bands into which the architraves of the Ionic and Corinthian orders of the architrave are divided.

Fillet—A narrow vertical band. The narrow spaces between the flutes of the Ionic and Corinthian columns.

Guilloche—A network-like ornament, used generally to embellish the torus.

Modillion—The ornamental block or bracket used at regular distances, sometimes under the cornices of the Ionic order, but much more elaborate and more frequently used in the Corinthian order.

Ovolo—The molding in the molded head of the Doric column. Meaning egg-shaped.

Plinth—The lowest member of the base of a column, square and vertically faced.

Scotia—A concave molding most frequently used in bases. It throws a shadow on itself.

Torus—A molding most frequently used in bases. It is convex, very nearly semicircular, and generally the lowest molding in the base.

Volute—The special ornament of the Ionic capital.

III.—THE TUSCAN ORDER.

The illustration presents the main features of the so-called Tuscan order of Architecture, an order which the Romans appear to have modified from their Doric, at least it may be said to be a simpler form of the Doric, wherein the triglyphs, mutules and guttae are omitted, and the members of the entablature are carried throughout the whole length.

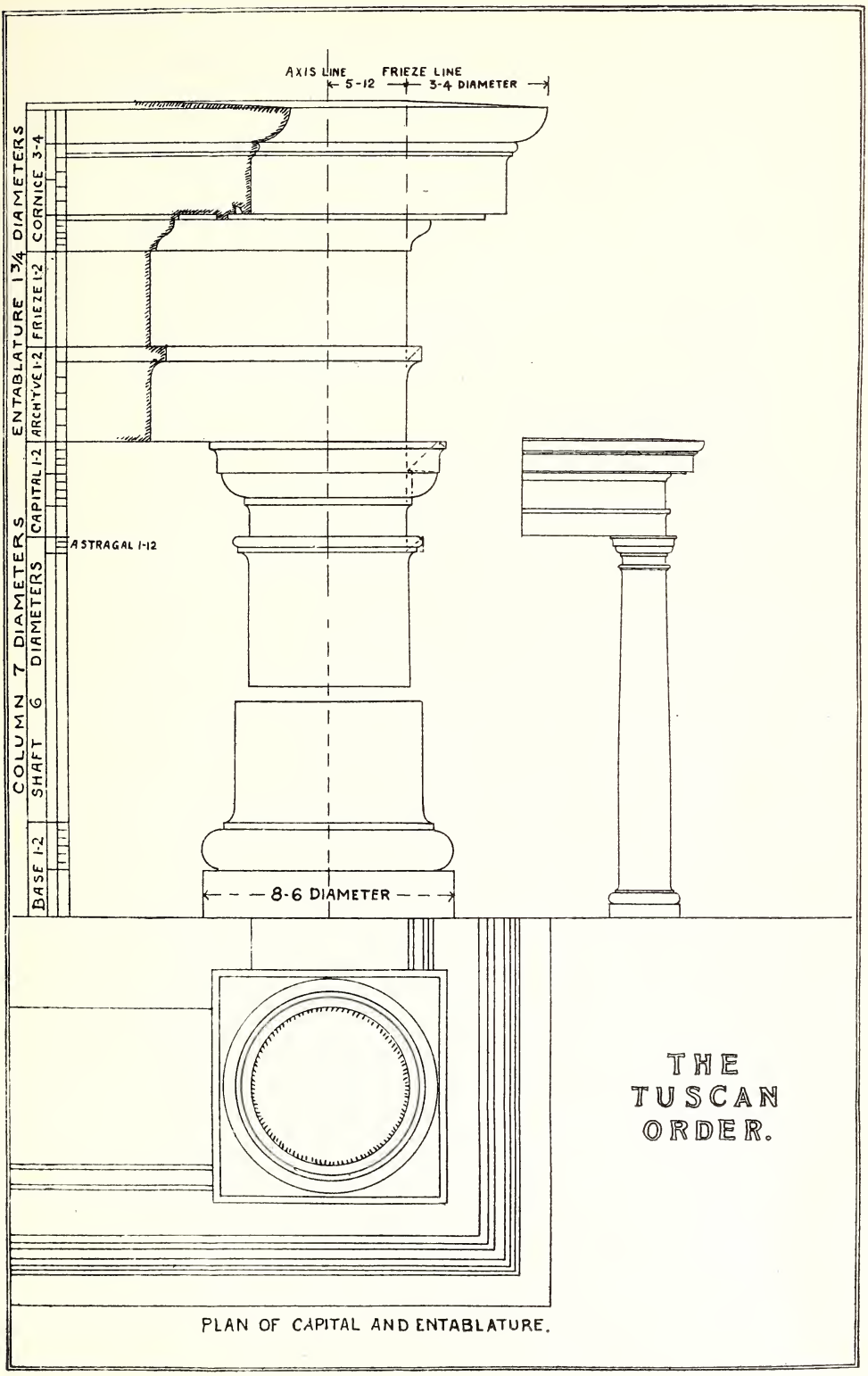
It has been a matter of considerable discussion whether the Tuscan should be admitted as an order at all, for no ruins or examples have been left to us of any complete structure of this order, and it would appear that the description of its details by Vitruvius were so obscure that several interpretations have been made, resulting in as many conclusions by students of ancient architecture. In consequence the proportions by these several authorities differ more or less.

It was said above that no complete illustration of the order has been discovered in the remains of antiquity, although a number of columns, notably the Trajan column at Rome, give color to the idea that Roman architects made use of the Tuscan design to some extent.

Vitruvius in his description of the principles of the order does not speak of it as of a distinct nature, although mentioning the construction of certain Tuscan temples. This ancient authority makes the shaft six diameters in height, with a diminution of a quarter of a diameter, the base half a diameter and the capital half a diameter. He does not give a proportion for the architrave or cornice, omits the frieze, and places mutules over the architrave to project one-quarter height of the entire column, including base and capital, and he does not provide a pedestal.

Palladio, a noted Italian architect of the fifteenth century, whose influence is still more or less potent in classical architecture, placed the total height of the order at nine and three-quarters diameters, giving six to the shaft and a half each to the base and capital. He allows no pedestal, but puts the base on a plinth of one diameter in height.

Scamossi, another Italian architect, and


AXIS LINE
FRIEZE LINE
5-12
3-4 DIAMETER
COLUMN 7 DIAMETERS
ENTABLATURE 1 3/4 DIAMETERS
BASE 1-2
SHAFT 6 DIAMETERS
CAPITAL 1-2
ASTRAGAL 1-12
ARCH'TVE 1-2
FRIEZE 1-2
CORNICE 3-4
8-6 DIAMETER
THE TUSCAN ORDER.
PLAN OF CAPITAL AND ENTABLATURE.

pupil of Palladio, makes the entablature one-quarter the total height of column less one-half a diameter, and he gives a pedestal of the same height. On the frieze he places a sort of triglyph for decoration.

The lack of examples, and definite information concerning this order, coupled with the fact that the Romans altogether failed in refinement in their artistic efforts, that is to say, compared with the Greeks, detracts from the value of this style. It is inordinately plain, and so closely resembles Doric without its majesty or simple embellishments that it looks unfinished. Whatever the authority was that gave it the dignity of one of the great orders of classic architecture it is difficult to explain; but the adherents of Vitruvius and his methods have been strong in their leanings, and the old builder so impressed his followers that all the centuries since have experienced more or less of his classic vitality.

GLOSSARY.

Acloterium—Properly speaking, the ornament placed on the apex or summit of a pediment. It may be a statue.

Annulets—The small fillets or bands which encircle the lower part of the Doric capital directly above the neck.

Bed-Mould—The group of moldings situated under the projecting portion of most cornices—part of the cornice.

Cabling—When the flutes of columns appear to be partly filled with solid convex masses, they are said to be cabled.

Caryatides—Human female figures modeled to form columns or piers, or to support a load.

Cathetus—The eye of a volute in an Ionic column. A determined point by a line depending from the point where the volute generates.

Corona—The deep vertical face of the projecting part of a cornice between bed mould and covering mould.

Cove, Coving—When the moulding called the cavetto, or the inverted scotia, is used on a larger plan and not as a moulding, it is termed a cove or coving.

Cyma-Recta—A moulding, in outline a simple waved line, or reversed curve. When the concave part is placed uppermost it is a Cyma-Recta.

Cyma-Reversa—As above, with the convex part uppermost.

Cymatium—When the uppermost moulding of an entablature is a cyma, it is termed the Cymatium.

Module—The term generally applied by architects as a measure to determine the proportions of the parts of an architectural order. The half diameter of the base of a column is the module, which is again divided into thirty parts called minutes. This was the older method, the entire diameter has now generally taken its place. A column of nine modules would be a height of nine times its diameter.

IV.—THE CORINTHIAN ORDER.

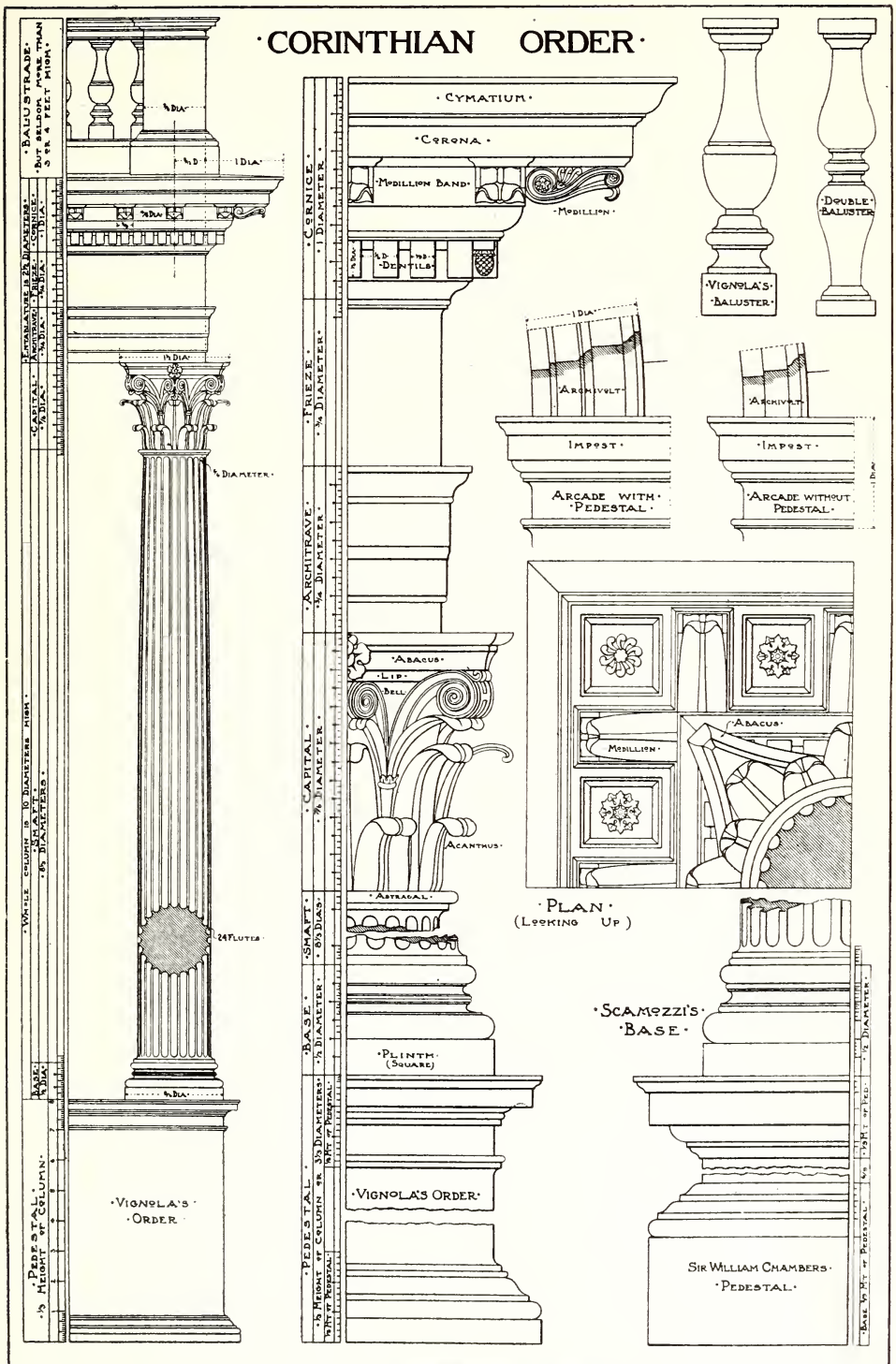
The fourth in the list of orders of architecture is the Corinthian, perhaps the most delicate as well as elaborate of all, and the order which, among the Greeks, seems to have been brought into greater use in certain respects about their domestic architecture than in either of the others. Its proportions are more slender and the individual parts are treated, so to speak, with more particular consideration in design and detail.

According to the authorities the Corinthian order displays its Egyptian origin, but like the features of art originally borrowed from Egyptian sources, the Greeks soon made it their own, by adjusting details after their own conceptions and design, with the freedom and taste of their nature.

For instance, the acanthus leaf, which they made the chief decorative feature of the capital, is essentially Grecian. The story of the development of the capital by Callimachus, stated to have been of the fifth century, B. C., from a woman's basket covered with a tile placed on a maiden's tomb, about which the leaves of an acanthus plant had arranged themselves, is a fable. The acanthus leaf was probably an ornament of long use with the Greeks for other purposes than architecture.

According to Fergusson, the Corinthian is, as a fact, a composite order, "made up of bell-shaped capitals of the Egyptians and the spiral of the Assyrians, and adopted by the Greeks at a time when national distinctions were rapidly disappearing, and when truer and severer art was giving place to love of variety. At the time, also, mere ornament and carving were supplanting the purer class of forms and the higher aspirations of sculpture with which the Greeks ornamented their temples in their best days."

While perhaps of early origin the order


CORINTHIAN ORDER
CYMATIUM
CORONA
MODILLION BAND
MODILLION
DENTILS
CORNICE
FRIEZE
ARCHITRAVE
CAPITAL
SHAFT
BASE
PEDESTAL
ABACUS
LIP
BELL
ACANTHUS
ASTRAGAL
PLINTH (SQUARE)
VIGNOLA'S ORDER
VIGNOLA'S BALUSTER
DOUBLE BALUSTER
ARCHIVOLT
IMPOST
ARCADE WITH PEDESTAL
ARCADE WITHOUT PEDESTAL
PLAN (LOOKING UP)
SCAMOZZI'S BASE
SIR WILLIAM CHAMBERS PEDESTAL
24 FLUTES
BALUSTRADE

does not seem to have been used to any extent until the time of Alexander the Great. The earliest example known is that of the Choragic monument of Lysicrates, ascribed to 335 B. C., which, although small in dimensions, is exceptionally beautiful in proportions and design.

There are, unfortunately, very few relics of ancient structures of the Corinthian order remaining. The Romans in due time adopted it, and as with the other orders, modified and subjugated it to their own national ideas.

The order comprises a stylobate, column and entablature. The relative proportions of this order are given in the drawing. The column is ten diameters in height, having a base composed of torus and fillet; scotia and another fillet, rather smaller than the other, and a second torus on which is a third filiet forming a base for the apophyge of the shaft. The shaft, like the Ionic, has twenty-four flutes and fillets, and diminishes with entasis to five-sixths of its diameter at the hypotrachelium, or moulding beneath the cap. The flutes are very deep semi-ellipses, almost semi-circles. The fillets are a little more than one-fourth the width of the flutes. Further details are graphically explained on the illustration.

The stylobate, or we might call it platform or base, differs in the Roman Corinthian, being much higher, as a rule, but it varies in this, as also in the arrangement of these parts.

The Corinthian capital would seem to have been incomplete in the hands of the Greeks, the order being the latest to tax their artistic sense, and the Romans taking it up certainly added to its fullness and beauty. It may have been, however, effected by Greek artists, acting under Roman orders. Probably very nearly a hundred Corinthian capitals of different designs have been found in Rome and portions of the Roman Empire executed during the three centuries of Rome's imperial existence. These serve to display in a measure the various influences at work on architectural art of the period.

GLOSSARY.

Necking—The annulet, or series of mouldings, which separates the plain part of the shaft of the column from the capital.

Ogee—A moulding named from its resemblance to the letter O placed over a G. Partly a hollow and partly a round.

Order—The column with its stylobate and entablature comprise an order. Vitruvius is probably the cause of this dogmatic term.

Ovolo—The term applied to the moulding which with an abacus formed the capital of the Doric column.

Pedestal—The term applied to any isolated mass which is used as a support for a statue or other such object.

Pediment—The part of a portico which covers the end of the roof above the entablature, hence its triangular form.

Pilaster—A projection from or against a vertical surface, having the appearance of a column, frequently with its form and decorations.

Planceer—Used frequently instead of soffit. It is more correctly applied to the soffit of the corona in a cornice.

Plinth—In the Roman orders the lowest member of the base of a column is square with vertical faces. This is the plinth.

Portico—The open space between the door and the columns in a column fronted building.

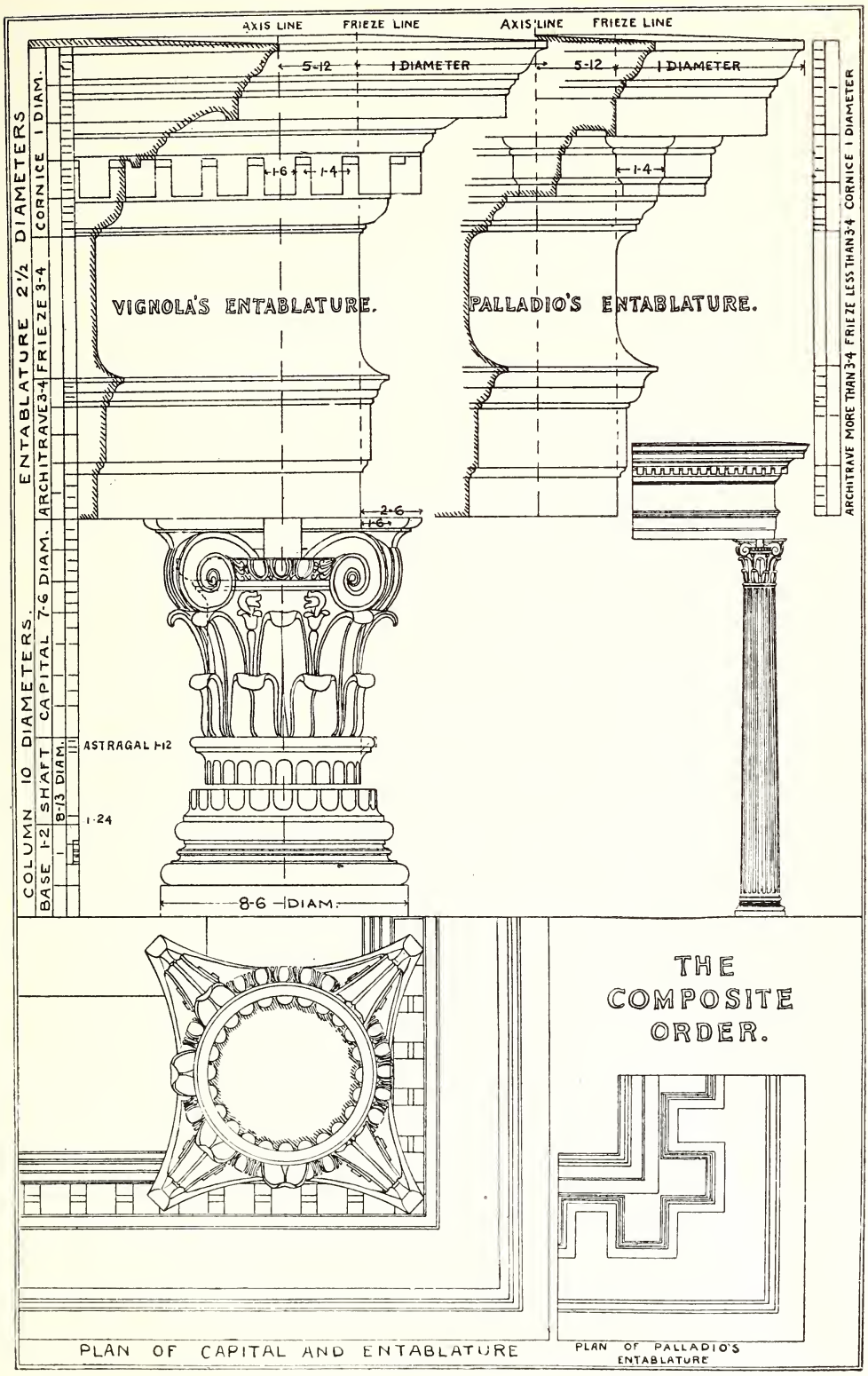
V.—THE COMPOSITE ORDER.

The fifth and commonly called the last of the five orders of architecture, is the Composite. It is, as its name implies, a composition, comprising certain parts or features of the other four orders. For instance, in the design of its capitals are the volutes of the Ionic order, and the rows of Acanthus leaves of the Corinthian. The quarter round of the Tuscan and Roman Doric is also used in this order.

In the illustration two examples of entablature are presented from the two great authorities on classic architecture, Vignola and Palladio, and the differences are very readily discernible from the sectional outlines shown. The arrangement and general proportions of the order range very closely to the Corinthian and indeed, with the exception of the capital itself, the Composite differs less from the usual examples of the Corinthian than various forms of Corinthian differ among themselves, as may have been inferred from the number of Corinthian capitals that have been found.

The Composite order was used principally by the Romans in their triumphal arches, and except in such architectural features of Roman civilization, in its best days, we do not find it in use any where else.

The main characteristics of the capital


AXIS LINE
FRIEZE LINE
AXIS LINE
FRIEZE LINE
5-12
1 DIAMETER
5-12
1 DIAMETER
1-6
1-4
1-4
VIGNOLA'S ENTABLATURE.
PALLADIO'S ENTABLATURE.
ENTABLATURE 2½ DIAMETERS
CORNICE 1 DIAM.
FRIEZE 3-4
ARCHITRAVE 3-4
CAPITAL 7-6 DIAM.
SHAFT
8-13 DIAM.
BASE 1-2
COLUMN 10 DIAMETERS.
ARCHITRAVE MORE THAN 3-4 FRIEZE LESS THAN 3-4 CORNICE 1 DIAMETER
2-6
1-6
ASTRAGAL 1-12
1-24
8-6 DIAM.
THE COMPOSITE ORDER.
PLAN OF CAPITAL AND ENTABLATURE
PLAN OF PALLADIO'S ENTABLATURE

are the enlargement of the volutes to a fourth of the height of the capital, and the method of connecting their stems horizontally under the abacus. The drum of the capital is girded under the stem of the volutes by a molding as shown. Two rows of Acanthus leaves occupy the balance of the drum of the capital up to the volutes, and are therefore set higher than in the Corinthian.

However, the Romans varied the details of design in this order, even in the capitals, incorporating animals of various kinds, the human figure, armor, foliage and other objects. Nor were the columns always designed after one type, many relics having been found to establish this statement.

The great use of a proper understanding of the principles of the orders of architecture lies in the proportion and relation of the several members. How well adapted to the order is every detail of it, and when assembled into the completed forms, how harmonious is the whole. No lack of proportion in any particular feature of the composition mars the general effect, every detail bears its weight of importance, the absence of which would make itself apparent at once, and the beauty and harmony of the whole would be impaired. The sense of proportion and harmony was wonderfully developed with the Greeks and this added to their natural appreciation of the cause and effect of beauty, led to the creation of works of art which in certain respects have been unexcelled, and which serve to maintain certain principles of art, as developed by the Greeks, standard today.

Proportion, harmony, beauty, are as much essential principles of monumental designing today as ever, and a broader and more enlightened handling of designs, with a more decided appropriateness to surroundings and requirements, will be the reward of the student of the orders of architecture.

GLOSSARY.

Prostyle—A portico, the columns of which project beyond the building to which it belongs.

Regula—The short fillet or rectangular block, under the taenia, on the architrave of the Doric entablature.

Scotia—A concave moulding usually used in bases. It projects a deep shadow on itself. It resembles a reversed ovolo.

Shaft—In classical architecture is that part of the column between the necking and apophyge at top of base. It is also now used in a broader sense.

Soffit—Comes from the Italian, meaning ceiling. It is the inverted face, or underside of an entablature, or under face of an arch.

Stoa—The Greek term for its equivalent of Porticus in Latin and Portico as used in English.

Stele—A small monument. The ornament on the ridge of a Greek temple, or monument.

Style—The term originally applied only to columns or an arrangement of columns. Its broader meaning now is to signify the differences in the mouldings, general details and other features of the architecture of various nations.

Systyle—Where columns are thickly set —two diameters.

Stylobate—Is the basement of columns —where it is continuous—in contrast to pedestal which is the base of an isolated column or other structure.

Scroll—Is the same as volute, but volute is usually restricted to the scroll of the Ionic capital.

Stereobate—Also a base but distinguished from stylobate in that it has no columns.

Table—A term applied to various mouldings, such as string courses, cornices, etc.

Tetrastyle—A portico having four columns in front.

Torus—A swelling, a convex moulding which approaches to nearly a semi-circle. It is generally the lowest moulding of a base.

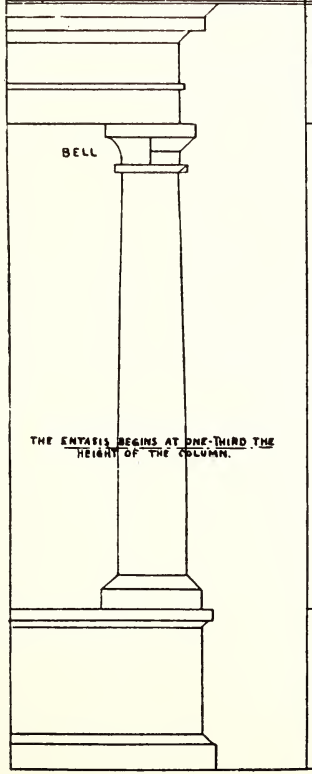
Tympanum—The recessed space formed by the triangular cornice of the pediment.

Volute—The spiral ornament which forms the distinguishing characteristic of the Ionic capital.

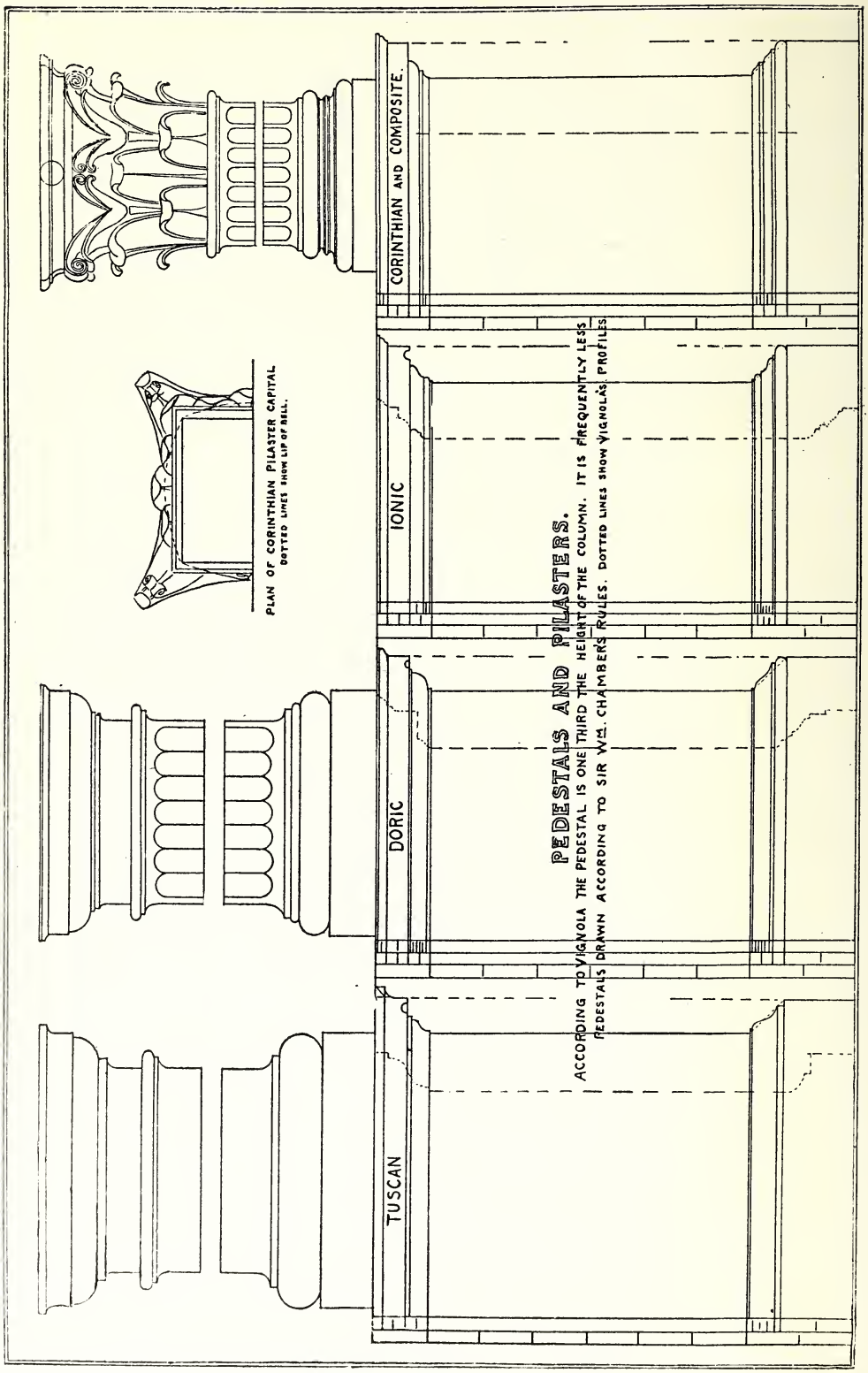
VI.—COMPARISON OF THE ORDERS.

Another illustration in this series gives a comparison of the orders, arranged so that with a little study the variations in the proportions of the various features of the several orders may be understood. One of the striking characteristics of Greek architecture is its accuracy. Proportion and relation of the several parts, one to the other, was maintained with the greatest precision, and when we look at the direct lines of the diagrams of the orders as they have passed through these columns one does not at once realize to what end such

COMPARISON OF THE ORDERS.



TYPE OF ORDER		NAMES OF FEATURES		GREEK DORIC		TUSCAN		DORIC		IONIC		CORINTHIAN & COMPOSITE	
	ENTABLATURE ¼	CORNICE	CYMATIUM	2	1-2	1¾	3-4	2	3-4	2¼	7-8	2½	1
			CORONA										
			BED MOULD										
		FRIEZE			3-4		1-2		3-4		6-8		3-4
			TAENIA										
		ARCHITRAVE			3-4		1-2		1-2		5-8		3-4
	COLUMN	CAPITAL	ABACUS		1-2		1-2		1-2		1-2		7-6
			ECHINUS										
			NECKING										
			ASTRAGAL										
		SHAFT		4 to 6		7	6	8	7	9	8	10	8⅓
			CINCTURE										
		BASE	BASE MOULD		NONE		1-2		1-2		1-2		1-2
			PLINTH										
	PEDESTAL ⅓	CAP	CORONA	THE CAP IS ONE NINTH THE HEIGHT OF THE PEDESTAL.									
			BED MOULD										
		DIE		ACCORDING TO VIGNOLA THE PEDESTAL IS ALWAYS ONE THIRD THE HEIGHT OF THE COLUMN. IT FREQUENTLY VARIES FROM THIS.								
		BASE	BASE MOULD	THE BASE IS TWO NINTHS THE HEIGHT OF THE PEDESTAL.									
			PLINTH										


PEDESTALS AND PILASTERS.
ACCORDING TO VIGNOLA THE PEDESTAL IS ONE THIRD THE HEIGHT OF THE COLUMN. IT IS FREQUENTLY LESS
PEDESTALS DRAWN ACCORDING TO SIR WM. CHAMBER'S RULES. DOTTED LINES SHOW VIGNOLA'S PROFILES.
TUSCAN
DORIC
IONIC
CORINTHIAN AND COMPOSITE.
PLAN OF CORINTHIAN PILASTER CAPITAL
DOTTED LINES SHOW LIP OF BELL.

apparent absoluteness leads. And yet the rigid laws of proportion which governed the design resulted in the perfect works, some remnants of which still exist, to prove the delicacy of reasoning which the refined architects of Greece brought to bear in their work of reducing their styles of architecture to definite proportions. By their system they could calculate with remarkable precision the sizes, and their rules as at present understood may be applied to what remains of their works with the certainty that variations from the calculated figures will be practically imperceptible.

An appreciation and study of the proportions and principles of the orders, as given here, and comparison of the several features in the plate will suggest ideas and cultivate refinement in whatever line of monument work may be under consideration.

VII—PEDESTALS AND PILASTERS

The closing plate of this series is devoted to Pedestals and Pilasters and carries its own explanation. Many of the great students of classic architecture differ on the question of dimensions, and to some extent proportions, and in the plate herewith, the outlines of the pedestal are drawn on the lines laid down by Sir William Chambers, a noted architect, and those advocated by Vignola are shown in dotted lines. The projection of the wall seldom exceeds between one-third and one-fourth of its width. The details of the pedestals require much study and careful designing, but to this end the classic proportions are of value in determining final values. Properly proportioned details in ornamental designing are essential to a well balanced design; and in this the relation of the mouldings and other component parts, to each other and to the whole, is the necessary study of any one aiming to produce work that will neither disappoint the eye at the moment, nor become tiresome in time. The beautiful proportions of classic architecture give it the power of exciting greater interest the more it is inspected and studied.

PLAN FOR IMPROVING CEMETERY LOT

The writer is very much interested in planting for his own lot the coming spring. Kindly state proper name or names of the vine or plant that is shown covering the graves in cuts 33 and 35; where and how to buy it; amount required for each adult grave; proper preparation of the ground; whether or not it will stand the winter. My lot is full of ground moles and they work under the sod and keep it torn up. How can they be gotten rid of? How can the ground be prepared to raise a good set of grass? How and when should this be done and what kind of seed would be best? I expect to erect on my lot an exedra style monument about eight by ten feet long and about three feet wide at base and not over six feet high. The lot is twenty feet square and the monument will sit on upper edge of lot (lot is on slight hill), facing down hill over entire lot. What kind of plants or shrubs would be best suited for planting at either end of base? Give proper names and where they can be obtained. Of course, these should be something that will stand the winter weather here in southwestern Pennsylvania.—Mont. Wks., Pa.

The exedra style of monument is gaining in favor, especially when it is properly placed in the cemetery with room on the lot to allow for planting back of it, and having an open view of it from the adjacent road.

In selecting a cemetery lot it is much to the advantage of the purchaser to consider the relation of his lot to the road near by, also the possible background his monument will have when it is erected. Sometimes it is possible to secure a lot with a background planting already in place; a planting that was provided for in the plans prepared by the landscape architect who arranged the roads, platted lots and designated plantings.

Your inquirer, however, asks information about planting at ends of such a monument which he proposes to place at the edge of the lot.

First of all, I would not place a monument at the exact edge or lot line unless the space back was parked space.

With a lot 20x20 and an exedra monument of the size mentioned, the entire half a lot should be set aside for the monument and planting; this would allow space for five graves on the other half.

If the exedra is placed in the center of the half lot, allowing five feet from the lot line to the end and at least three feet from the rear line of lot to the center portion of the exedra, this will give a

better planting space, as shown in illustration.

The preparation of the soil would be to some extent a matter of local conditions. Any reasonably good soil will suffice for shrubs, trees and vines, but a little care in preparation will be well repaid.

The areas to be planted should be spaded to a depth of 16 to 18 inches and any heavy clay removed. In case of rock, it should be removed to a depth of three feet. The space resulting from the removal of rock or poor soil should be refilled with good soil, preferably a mixture of a considerable portion of friable clay and enough loam or well-rotted compost to lighten the clay. The grub worm does not like a clay soil and the mole consequently does not hunt him there.

The graves could be planted with Periwinkle (Vinca minor), which is evergreen, or English ivy (Hedera helix). The latter would probably have to be protected in winter. These two plants probably make the neatest ground covers.

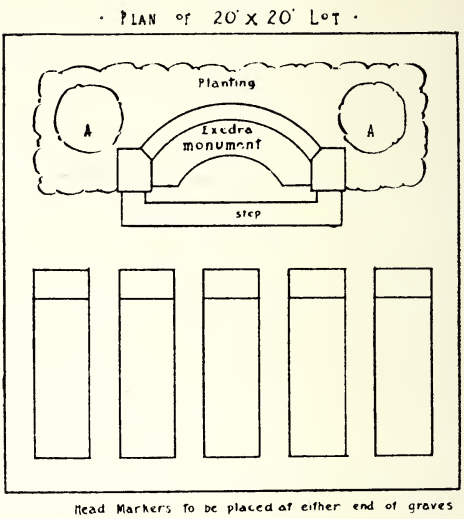
In planting it is better taste to use masses of plants rather than a mixture of various kinds in a small group.

The following planting suggestions are offered:

First: (AA) could be Althaea (Hibiscus syriacus) for summer blossoms, with Van Houtte's spiraea (Spiraea Van Houttei) for spring flowers.

Second: (AA) could be Tamarix (Tamarix gallica) summer blooming, with Hydrangea (Hydrangea paniculata grandiflora) between, for fall blossoms, and at the ends of the monument Deutzia ((Deutzia gracilis).

Third: (AA) could be Purple Barberry (Berberis purpurea) for color of foliage in spring and summer and berries in winter, with the Lemoines Deutzia (Deutzia Lemoine) between and paeonias at the ends, alternated with Lespedeza



penduliflorum. Paeonias for spring flowers and Lespedeza for fall.

Fourth: (AA) could be Pyramidal Arborvitae, either American (Thuja occidentalis pyramidalis) or Oriental (Thuja orientalis), with Mountain Laurel (Kalmia latifolia) between and Azalaea at the ends would make an evergreen group.

There are so many good varieties of hardy shrubs and small evergreens that this list might be extended indefinitely.

These groups are suggested with the idea that they are not to be planted under trees.

For varieties of seed for lawn, ask your local seed man.

HARE & HARE.

USE AND CARE OF PNEUMATIC TOOLS.

This is a broad subject to cover in a paper of this kind, and as a matter of fact it cannot be treated in any other way than to simply touch upon some of the more important points as regards the construction, operation and care which should be given pneumatic tools in order to obtain the highest efficiency and value from their use.

Perhaps it is not a very interesting subject, but from our experience in the manufacture of pneumatic tools we can safely say it is of sufficient importance to demand the closest attention from users of these devices. We know that thousands of dollars are spent every year in the repair of tools and in the purchase of new ones for which there would be no necessity if proper care was taken of the old ones. We do not believe that any pneumatic tool manufacturer is making any money from his repair department, and if we could eliminate repairs on our tools and apparatus, we would willingly spend any reasonable amount of money to accomplish the object.

From these remarks it might seem that we are acting against our own interests in advocating closer attention to this part of your plant, but such is not the case. If our customers can be brought to the realization that their pneumatic equipment can be rendered more efficient through proper attention to these matters than it is at the present time, we profit in the end as well, as for any business house to be a permanent success, it is an absolute necessity for its customers to be satisfied with its products and realize the fullest measure of profit from their use.

The remarks which follow are applicable to practically every make of pneumatic tool on the market at the present time.

A pneumatic tool has a peculiarity over any other operative device, inasmuch as the piston or actual working member of the tool is not rigidly connected to any other part of the mechanism, but is floating, as it were, in the cylinder and propelled in one direction or the other by the air being admitted at each end of the piston, either by a valve as in the case of plug and rock drills, hand facers, and surfacing machines, or by the piston itself, as in the case of carving tools. It is for this reason that so little is required in the way of dirt, cutting of the piston or barrel, or improper lubrication to cause a decided loss in the working efficiency of the tool.

The highly polished, accurately fitted surfaces of the internal parts of a pneumatic tool are particularly susceptible to the action of rust, caused by dampness when not in use, and à tool should never be laid away, even over night, without the precaution being taken of inserting a few drops of oil in the inlet, attaching to the hose and running the tool for a second, so that the oil will be carried through by air and form a thin film on the working parts.

A much better plan, however, and one that is practiced successfully in a large number of plants, is to have a tank large enough to hold all the tools in use filled with kerosene and gasoline, and when the tools are not in service, keep them immersed in the oil. This serves a double purpose—the tools are kept from rusting and the gasoline or kerosene cuts and softens any deposit of oil or dirt in the air passages of the tool that may come from the compressor. In the morning the tool should be connected with the hose and thoroughly blown out, then disconnected, a little oil (just a few drops) used, and it is ready for operation.

A few drops of oil inserted at intervals of a couple of hours throughout the day should be sufficient. Always use a light, limpid mineral oil, and under no consideration whatever use an animal oil, such as lard oil, sperm, etc., as these have a tendency to gum and clog up the air passages. Many tools coming in the shop for repairs plainly show the ill effects of using animal or heavy mineral oil. Oftentimes it is necessary to boil them in lye water for a number of hours in order to loosen up and remove the deposit of oil and gum in the parts. Even this is not sufficient in many instances, and the removal of a casing and replacement of same is necessary in order to properly clean out the passages.

When a carving tool refuses to run, the trouble almost invariably is due to the piston or inside of the barrel having become roughened by a bit of dirt or grit. To remedy this, take the tool apart with a piece of fine emery or crocus cloth, or oilstone, rub the abraded part of the piston smooth. It more often happens that the piston is rougher than the barrel, and if it is found that the barrel has suffered also, take a stick about the radius of the hole and with the emery cloth carefully smooth out the rough places. Then dip the tool in kerosene, blow out thoroughly with air,

and put together and it will generally be found to operate satisfactorily. Never put a piston on a grindstone to smooth down a rough spot, as the chances are that the piston will be ruined.

Sometimes difficulty is experienced in starting a new tool, due to the snug fit of the piston in the barrel. In a new tool, when properly fitted, the piston is not more than one-quarter thousandth of an inch smaller in diameter than the barrel in which it works, so you can readily understand why it does not require much dirt in order to cause trouble. It is therefore necessary that the greatest precaution should be taken during this breaking-in period, as it might be termed, of a new tool, and care and attention paid it until the piston has become worn absolutely smooth, as the least particle of dirt or grit will either cause the tool to stop entirely or will cut the piston to such an extent that it will be necessary to take the tool apart and dress the piston and barrel as before mentioned. It is for this reason also that a new tool frequently runs warm during the first few days of its use. This fact that a new tool runs slightly warm when it is first started is rather a point in its favor than otherwise, as it is an indication of a perfect fit of the piston in the barrel, and this running warm will generally disappear after a few days' service.

Three-eighths-inch hose has come to be regarded as the standard hose for use with Carving Tools. This is correct as far as the size of the hose goes, provided the passage in same is not obstructed by pieces of the inner tube becoming torn and rolling up, or by the use of nipples or fittings in which the openings are too contracted. We have known instances where complaint was made that a tool was not as efficient as it might be, and on examination found the hose in some part of its length to be so obstructed by the rolling up of the inner tube that there was left a passage of an actual diameter of less than ⅛-inch, which size opening will not permit the proper quantity of air to pass through to operate a Carving Tool to its best efficiency.

When attaching a tool to the hose, always see that the nipple is screwed tight into the head, otherwise the jar and vibration will soon destroy the threads on both the nipple and in the head. It is a very good plan to screw a male and female nipple in tight in the head and leave it there, then the threads of the head are protected and the nipple can easily be replaced when worn out. As a matter of convenience, many workmen prefer to use the tools loose on the nipple, which, if the nipple is screwed directly into the head of the tool will soon ruin the threads, and especially where this is the case the M. & F. nipple should be used without fail.

Trouble is often experienced due to the hole in the nipples being too small. Never use a nipple with a Carving Tool which has a clear opening through it of less than ¼-in., and the larger it is the better, as it causes less friction and wire drawing of the air in its passage to the tool. To get the best results from a Carving Tool, or in fact any Pneumatic Tool, the supply of air at the tool should be kept as near as possible at the Receiver pressure, any contraction or clogging of the passages, either in the hose, nipples or cocks, will cause a lowering of the pressure at the tool, consequently lowering its efficiency. Of course, in work like fine carving, etc., it is necessary at times for the workmen to throttle off the air at the cock and the above remarks do not apply in this case.

If a tool does not start immediately when the air is turned on, some workmen make a practice of striking the nose end violently against a stone, or other hard substance in order to start it, which should not be done, as it is apt to injure the tool. In nine cases out of ten it can be started by simply placing the thumb over the exhaust port and removing it suddenly. If this does not start it, insert a chisel in the tool and strike the chisel lightly against the stone.

A bushing in a Carving Tool should not be allowed to become excessively worn before replacing. In many instances where tools are sent in for repairs the bushing has been worn entirely through due to the workmen always holding the tool in one position. Where this condition exists the piston is likely to fracture owing to the fact that the chisel is not held square in the tool and the piston strikes it an oblique or glancing blow.

It would seem almost unnecessary to caution against the use of a pipe wrench on the barrel of a Pneumatic Tool in taking same apart, but the fact that we continually have tools coming into the shop for repairs on which the casings have been ruined, and in many instances the barrel broken or cracked by the use of a pipe wrench would seem to indicate that

a few words on this subject might not be wasted. There is no make of Pneumatic Tool on the market at the present time that we know of on which it is necessary to use a pipe wrench to remove the head. If flats are not provided, or if they have worn off so that an ordinary wrench cannot be used on the head and barrel, the proper procedure to follow is to clamp the head in a vice, and with a short piece of ¼-in. or ⅜-in. rope, take several turns around the body of the tool and with a stick or lever through the bight of the rope unscrew the tool from the head, seeing that the locking pin is properly depressed and there is no mechanical obstruction to the removal of the head except the friction of the threads.

Another point in which economy can be exercised in the use of Carving Tools is to have the proper tools for the work in hand. In other words, do not try to do a heavy rough job with a ¾-in. or 1-in. tool when a 1¼-in. tool would do it in one-half the time. It will not take long to pay for the extra tool.

One more point, and an important one, that should be observed in the use of a Pneumatic Tool, is to see that when the workmen lay them down temporarily they are not thrown indiscriminately into a pile of dirt, as stone dirt or grit finding entrance through the lower end can do just as much damage as if it came through the hose from an unscreened compressor suction. Workmen should also be instructed to thoroughly blow out the hose and see that it is perfectly clean before screwing the tool on to the nipple, as it is common practice to let the end of the hose drop into the dirt when the tool is unscrewed, and more or less of this will find its way into the tool to the serious detriment of same if this precaution is not observed. Blowing out the hose also answers another purpose, in that it disposes of the water which might have settled in the pipes and hose during its period of non-use.

Chisels used in Carving Tools should receive constant and careful attention. The upper end of the bushing in a tool is provided with a shoulder which acts as a stop for the end of the chisel shank, and the piston is proportioned as to length so that when it comes down and strikes a chisel held up against this shoulder, the exhaust ports in the upper end of the barrel are opened just the proper amount to allow the air to escape from the upper end and the piston to make a full return stroke. Therefore, it is obvious that the shanks of chisels should be kept square on the end, and full size up to the end. If they are dubbed off on the end, or are so small that they pass up at all beyond this shoulder, they will prevent the piston from making a full downward stroke, the air pressure at the upper end will not be relieved, and the complaint will be made that the tool has lost its power. Of course, after long continued use the shoulder of the bushing will gradually be worn so that it lets the chisel up too far and the same result of loss of power will be observed, but in this case it is better to send the tool into the shop for adjustment and repair.

The matter of keeping chisels square and flat on the end is extremely important. When the end of a shank is rounding, the impact of the piston's blow is not distributed over the entire striking surface of the piston as it should be, but is concentrated in one particular spot with a consequent liability of fracturing the piston. As a matter of fact, a far greater number of pistons are broken in this way than are due to defects in the pistons themselves.

It is, of course, just as easy to make the shank of a chisel hard as it is the piston, and the certain consequence if chisel shanks are as hard, or harder than the piston, and do not have a true surface at the upper end, is that the piston must suffer, so it is always good practice to have the shanks of chisels softer than the piston. The proper color or degree of hardness is what is termed pigeon blue.

Point and bush chisels used in Surfacing Machines and hollow steels used in Rock Drills are particularly subject to breakage in the shank after a longer or shorter period of use, due in most cases to crystallization of the metal caused by the incessant vibration incident to their use. A way to very effectually curtail this breakage is to periodically, say every two weeks, in the case of Surfacing Tools, where they are constantly being used, anneal the shanks by heating them to a low red heat, covering up with ashes and allowing them to cool slowly; then after they are cool, reheating and toughening the end of the shank. This annealing process allows the molecules of the metal to assume their original positions or conditions from which they have been disturbed by the constant impact of the piston.

Shanks of chisels used in Hand Facers

and Plug Drills should be 2½ in. long from the end of the shank to the extreme end of the fillet. It is important for the proper operation of these tools that this length be maintained as accurately as possible, as the length of the shank determines the stroke of the piston. In dressing chisels used with Hand Facers, Plug Drills and Surfacing Machines, see that the end of the shank is perfectly flat with a small bevel at the upper edge.

From the point of efficiency it is best to use as short and light a chisel as possible in connection with a Surfacing Machine, as when a long, heavy chisel is used a large portion of the energy and momentum of the piston or hammer is taken up and absorbed by the inertia of the chisel due to its weight, so that the actual work accomplished would be in inverse ratio to the weight of the chisel. The efficiency of a Surfacer can easily be reduced 25 to 50 per cent by the use of inordinately heavy chisels, and you can readily see that if this weight of the chisel is carried to an extreme limit a point would soon be reached where the piston would have practically its whole energy consumed in the chisel, and very little work would be accomplished.

When a Plug Drill, Hand Facer or Bumper, as they are commonly called, or Surfacing Tool, stops suddenly, in nine cases out of ten the trouble is something small and unimportant. Outside of the possible breakage of an important part like the piston, the usual difficulty will be found to be either a cutting of the piston or barrel due to dirt or grit, as has been mentioned in connection with Carving Tools, or the stoppage of some port of passage by dirt, or a piece of the rubber lining of the hose. The first thing to do in case a tool of this kind stops is to take it apart and determine if the valve and piston are uninjured and in perfect working order. If this is the case, take a piece of wire and probe the ports in the valve box and barrel, and you will generally find the difficulty. When a tool stops on account of wear, it does not stop suddenly, but gradually falls down in efficiency and at last refuses to run. For a considerable length of time before stopping entirely, however, its efficiency is so reduced as to be readily noticeable.

When a tool of this kind stops from wear the trouble is not, as is generally supposed, in the valve, but is due principally to wear on the tit of the piston or in the lower end of the barrel where the piston comes through. In the case of Surfacing Machines this would be the barrel bushing, but in Plug Drills and Hand Facers this lower end of the barrel is not removable, and the only cure for it is to send it into the shop and have the barrel and this lower hole lapped out concentrically one with the other, and have the piston made with a tit to accurately fit the hole. In the case of a Surfacing Tool it is simply a renewal of the barrel bushing that is required and often times the old piston can be used, as frequently the wear occurs more in the barrel bushing than it does on the piston, so that while the barrel bushing may be worn to such an extent that the tool is practically down and out, the tit of the piston may be very close to standard size.

In Plug Drills this difficulty may sometimes be partially remedied by a new piston, as the tit of the old one may be badly worn and a new piston of standard size may reduce the leakage at this point so as to make it for a time a very good working tool, but the proper way is to send it to the shop and have a new piston fitted to the relapped barrel.

To obtain a smooth running Pneumatic Tool it is necessary to properly proportion the amount of air which is allowed to flow to the bottom end of the barrel during the upward stroke of the piston and this proportioning is obtained by the size of the port or passage leading from the valve box to the lower end. If too little air is admitted, this is, if too small a hole is used, the action of the tool will be slow and sluggish, due to its not obtaining a sufficiency of air or enough pressure at the bottom to raise the piston quickly, and if the hole is too large and too much air is admitted, in the case of Plug Drills and Hand Facers this will result in a very rough running tool with excessive vibration, while in Surfacing Tools the piston will strike and damage the valve box.

This is a lengthy matter to go into and probably would not be very interesting from a practical standpoint, and the only reason we are mentioning it is to illustrate why this wear of the tit of the piston and lower end of the barrel so seriously affects the efficiency of the tool.

Of course when a tool is new a considerable margin, or as much as is permissible, is allowed in the way of admittance of air to the lower end, so as to counter-balance considerable of the wear, but as the

tit of the piston or barrel bushing wears, the leakage becomes such that the port which was properly proportioned when the tool was new, is no longer able to furnish a sufficient amount of air to raise the piston to the top of the barrel. The consequence is that the stroke of the piston becomes shorter and its upward movement slower, until in the end the leakage becomes so great that the port is no longer able to furnish sufficient air to perform its function.

As an illustration of what this leakage amounts to, we can take for example the large Surfacing Machine Tool, the piston of which has a tit 1¾ in. in diameter. When the tool is new, the tit of the piston is practically an air tight fit in the bottom, or in the barrel bushing, but let the difference in diameter between the tit and barrel bushing be, say, two thousands of an inch, this area, taking it round the circumference of the tit will amount to the same area as a hole ⅛ in. in diameter, so that you can readily see that in addition to the falling off in efficiency of the tool, you are also wasting air which would flow through an opening ⅛ in. in diameter during one-half of the time of the operation of the tool, and which in horsepower at 80 lbs. pressure would amount to practically 2 h.p., or 12 cu. ft. free air per minute.

The same conditions which we have mentioned regarding wear at the lower end of the piston also applies to the valve, but in a smaller degree. Of course, this wear of the valve will in time affect the tool in exactly a similar manner as that of the piston, but the lower end of the tool is more important inasmuch as it is there that the greatest wear and consequent leakage occurs.

One extremely important point in the operation of all valve tools is that of keeping the tool tight. A Hand Facer, Plug Drill or Surfacing Machine Tool should never be operated for a minute after it becomes loose, but should instantly be taken to the repair shop and tightened, or in the case of a Surfacer Tool time taken to straighten up the clamping bolts. One day's operation of any of these tools running loose will do more damage and harm than three months' use under proper conditions.

Plug Drills should not be run for a single moment without a bit inserted on which the piston may strike. This is the principal reason why a Plug Drill is not suitable, and should not be used for bushing purposes, or for such work as the Bumper or Hand Facer is commonly used. The reasons for this are as follows: A Plug Drill, in order to be efficient as a Plug Drill, has a heavy piston and is not provided with a great amount of air cushion at the bottom end, so that when it is operated under conditions where the piston does not strike the chisel, as in the case of bushing, for it is simply impossible to do bushing work without, the tool is operating for a considerable portion of the time when the piston is not striking the head of the chisel; the piston of a Plug Drill will in this case hammer the bottom of the barrel and it will not take long to so injure it or upset it that the tool will be in need of repairs.

In a Hand Facer this is overcome by using a lighter piston and more air cushion at the bottom, so that even though these tools are operated without a chisel or bit, the piston does not strike the lower end of the barrel with sufficient force to do any damage. It is for this very reason also that while a Hand Facer will do Plug Drilling it will not do it with the efficiency and speed of a Plug Drill.

A Plug Drill piston, if it is allowed to strike the bottom of the barrel for any length of time will, as mentioned above, not only injure the barrel, but it will take but a very short period for the piston to crystallize at the lower shoulder where it strikes the barrel, causing the piston to break at this point and it will also be found that under these conditions it is almost impossible to keep the Plug Drill tight and in proper running order.

These same points come up in the operation of a Surfacing Machine. A Surfacer Tool should not be allowed to operate under these conditions any more than a Plug Drill, as aside from the crystallization sure to occur in the barrel and piston, this crystallization will also show its effects in the matter of bolts, clamps, and even in the carriage itself. Many operators of Surfacing Machines are careless in this respect, and a very large portion of the breakages of bolts and clamps are due to this very reason.

Oil is as much a necessity, or more so, in these tools, as it is in Carving Tools, due to the much larger wearing surfaces and the higher duty they have to perform.

In regards to repairs when necessary on Pneumatic Tools, it is always advisable to send the entire tool to the shop. For instance, when a valve box is sent in for repairs the factory can only put that par-

ticular part in a condition approaching as near as possible to that which it was in when new, but if the factory has the entire tool it can, when this part is repaired, give the tool a thorough test and determine whether it is O K before sending it back. The fact that the parts of a Pneumatic Tool are not independent of each other, but the operation of each depends upon the action of some other part, renders this course necessary in order to have the repairs properly made and satisfaction in the operation of repaired tools guaranteed.

Take as an illustration a Surfacing Tool that has been running loose. The effect in this case is for the valve box to hammer on the top of the barrel, defacing both the valve box and the upper end of the barrel, which point should be, and must be, air tight. If only the valve box is sent in, it is useless for the factory to grind and refinish the face which comes in contact with the barrel, as not having the barrel to refinish and regrind also, the condition as regards leakage at this point would be as bad, if not worse than it was before.

It is poor economy to operate a Pneumatic Tool as long as it will run or make a noise, as the moment a tool begins to lose in efficiency and cutting power, you are not only using more air, which is an insignificant item comparatively speaking, but you are really wasting the time of a high priced man in operating this tool. It is a very easy matter to lower a man's efficiency by 25 per cent in using a tool that should have gone to the repair shop some time previous.

While this paper is prepared with a view of touching on Pneumatic Tools only we have seen so many instances of bad practice in regard to the installation and operation of Air Compressors that we feel that a few words will not be out of place.

We urgently recommend that in all plants particular attention be paid to the suction of the air compressor. Air should never be taken from a room where stone cutting is being done as the air is filled with fine particles of grit, which are, in cases of this kind, constantly drawn into the Compressor and forced through the tools, with a consequent continuous grinding and cutting action. The ideal arrangement for a compressor suction pipe is to run it out through the roof of the shed and enclose the end of it in a frame work two or three feet square covered with a couple of thicknesses of fine muslin.

When the plant is being installed, nothing but new clean pipe should be used for conveying air to the tools. Every piece of pipe should be stood on end and hammered to jar loose any scale that may be on the inside, and every fitting should be inspected to see that it is perfectly clean. If old rusty pipes and fittings are used you will have endless trouble and annoyance from dirt and scale coming through the pipes and hose to your tools. These precautions will give a supply of cool, clean air, and the effective working of the plant will be increased 100 per cent over what it will be if installed and operated in the slipshod, slovenly manner that many plants are.

JOHN J. WALSH.

INSTALLING A POLISHING MILL.

We are thinking of putting in a polishing mill and there are several things we would like to know about it before we place the order for one, and it occurred to us that you might be able to get it for us through your Asked and Answered department. We will, of course, get an experienced man to run the mill when we get it in, but we want to know something about the amount of supplies to order and what kind most polishers use; the size of machine most satisfactory, and so on. If you will answer the following questions for us we will appreciate it very much:

How large a gasoline engine would it take to run a polishing machine using an 18-inch scroll wheel? How much surface would a machine of this size polish in a week running ten hours a day on Barre granite that had been properly hand pointed and had no holes or lifts to be ground out? What kind of abrasive works the stone fastest and how much would it take to polish a bed that contained 20 square feet? How much putty powder would it take for a bed of this size? Is it best to run belt direct from engine to polisher or should there be a line shaft put in? Which kind of machine will give the best satisfaction, one with a bevel gear at the top and drive pulley lying down, or one with the drive pulley standing up? What is the probable life of a polishing machine that is well cared for?—S. H., Mo.

Using the ordinary polishing machine, such as our "Carborundum" polisher, equipped with 18-inch scroll, requires about 12 horsepower to operate it satisfactorily, but if we were to equip it with a gasoline engine we would use a 15 horsepower, as you will readily understand a gasoline engine cannot well be overloaded.

This machine would average to finish six feet per hour on the harder granites and seven feet per hour on the softer granites. For further grinding the surface, after it has been axed or sawed, requires No. 3 chilled shot. After this, finer grains of emery or carborundum are used to prepare them for the final putty gloss.

It is better to run the belt direct from the engine to a countershaft with beveled gears connecting with the top of the vertical shaft of the polishing machine.

The life of a polishing machine is practically unlimited, unless it is destroyed by fire or by breakage, for all the bearings have removable bushings and these can be replaced at a very slight expense, thus making the polishing machine practically new. Properly used, the frame itself should never wear out. Of course, the grinding wheels and polishing heads are a separate matter and are made to wear.

The following figures on the amount of material per superficial foot are based upon polishing about 9,000 square feet of Massachusetts granite. The beds are made up large and small, so that if you wish to figure on polishing a bed of 20 square feet the amount would be somewhat in excess of the following: Shot, ¼ lb. per square foot; carborundum, ¼ lb. per square foot; iron, ⅛ lb. per square foot; putty powder, .015 lb. per square foot; emery, .003 lb. per square foot.

F. R. Patch Mfg. Co.

A polisher might run an 18-inch scroll on a large-sized polishing machine or he might use it on a small-sized machine. The horsepower to run this polisher with an 18-inch wheel depends considerably on the weight of the polishing machine and whether the weight of the wheels and scroll is run down hard on the bed. We would estimate that a 10-horsepower engine would be run to better advantage than one of less power.

Again, the amount of polishing material and time depends considerably on the ability of the polisher. A good polisher should turn out a bed of from 20 to 40 feet of polished work every eight hours. The difference in material used on a bed of 40 feet would be but little more than one of 20 feet. A 20-foot bed would average 25 lbs. of No. 3 Globe shot, 5 lbs. of No. 80 Crystolon, and ½ lb. Barre putty.

By all means we would suggest a gear top, so as to do away with all the shafting possible, and run the belt as straight as possible. With a tight and loose pulley we believe it would be best to connect engine direct.

With proper care the life of a polishing machine is indefinite, as the only places that wear can be easily replaced at a small cost. Our estimate here is in accordance with the general run of wheels in this section, but the amount of polishing material and time depends much on the ability of the polisher. Quality of work will have much to do with the time required.

A polishing wheel with an 18-inch scroll can be run on much less than 10 horse-

power, but under the proper pressure in ironing and grinding a bed you will find that the extra power is economy.

DEMING HARDWARE CO.

I cannot tell you how large a gasoline engine it would take, but there should be at least five horsepower with the engine. I cannot tell you how much a machine of this size would polish in a week; it would depend largely on the man and the condition of the stone. What this man would want in the way of abrasives would be Mowat's No. 3 iron and No. 80 carborundum, and it would require 40 ounces of carborundum to do 20 square feet. Marvelous putty powder is over 99 per cent pure tin, and a couple of ounces of this putty would be sufficient. It is better to run the belt direct from the engine to the polisher. If he has shafts and pulleys, it requires power to run them. I do not know that there is any difference in a machine with a bevel gear on the top or whether it is lying down or standing up. With the amount of work this man anticipates doing, the life of the machine would be ten or fifteen years.

R. C. BOWERS GRANITE CO.

The information called for is somewhat indefinite and uncertain, owing to the conditions in one locality, or one yard, being entirely different from that in another locality or yard. Furthermore, the kind of stone has everything to do with the results, besides the ability of the operator and many other conditions over which we have no control, so that any recommendations made are subject to all kinds of correction, depending upon actual working conditions.

For ordinary work it can be estimated that a 10-horsepower machine is absolutely sufficient to handle a granite machine with an 18-inch scroll wheel, but this also depends largely on the weight of the polishing machine and whether the weight of the wheel and the scroll itself is run down hard on the bed. The amount of polishing material and time depends so much on the ability of the polisher. It is safe to estimate that a good polisher should turn out a bed of 30 to 40 feet of polished work every eight hours, and in some instances it is possible to figure on even as high as a bed of 50 feet.

The difference of material used on a 40-foot bed is a little more than one of 20 feet. We believe that an average of 25 lbs. of No. 3 Globe shot, 5 lbs. of No. 80 Crystolon and ½ lb. of Barre putty is ample for a 20-foot bed.

There is quite a difference of opinion as to the use of the bevel-gear drive, although most concerns in the Barre district prefer same. In some instances, motors are belted direct to the rear driving shaft on the machine by means of a quarter twist belt. In this event it is wise to have tight and loose pulleys, so that the motor can be gotten up to full speed before starting the machine. In many cases it is found desirable to use a counter shaft, which gives, perhaps, better opportunity for reducing speeds when using motor drive. In case of a gasoline engine drive it is possible that the direct connection is best through a medium of a bevel-gear drive with tight and loose pulleys on the bevel-gear counter shaft.

The life of a machine, with proper care, is practically indefinite, as the wearing parts can easily be replaced at a small cost, the wear coming in the bearings, which are provided with renewable bushings, making the rest of the machine as good as new unless it meets with some accident.

LINCOLN IRON WORKS.

For a small polishing machine to operate on 18 to 20-inch scroll you would require a 5-horsepower gasoline engine. An 18-inch scroll would polish about 15 feet in ten hours, and in doing this amount of work it would consume about 8 lbs. of No. 3½ shot, 3 lbs. of carbolon and ½ lb. of white putty powder. It would be necessary to put in counter shaft in order to cut down speed between engine and polishing machine. The proper speed for scroll of this size would be about 200 R. P. M. Tight and loose pulley on back shaft of machine would be preferable. Gears we do not recommend for small machines. A machine of this type will outlast a generation if properly cared for. We recommend the Wright broken scroll ironing wheels. COOLEY-WRIGHT MFG. CO.

PLASTER CAST FROM LIFE.

"Will you please give me the best method of taking a cast off the face of a living person so that it can be used as a mold to make a plaster cast from?"—L. E., Pa.

There are many ways in which this can be done. There are a few precautions which must be taken in order to prevent injury to the subject from whom the mold is made. A towel should be carefully tied over the hair. Small wads of cotton should be placed in each ear. The skin should be rubbed with olive oil or vaseline. The subject should lie down on his back. There should be no conversation carried on during the process of making the mold, as this would destroy the cast. The eyebrows or mustache or beard could be filled with lather or vaseline; I would suggest vaseline for eyebrows and soap lather for mustache or beard. Pieces of tissue paper covered with vaseline should be placed over the eyes. Quills or straws should be placed in the nose and any remaining space filled with vaseline; or some people think it more successful not to put anything in the nose, in which case all the face is covered except the nose, and the subject inhales a deep breath and the plaster is then thrown over the nose. When the subject has held his breath as long as possible he blows out hard through his nose, blowing the plaster out of the nostrils, after which he is able to breathe, provided the caster does not put any more plaster over the openings. It is good to use warm water in mixing the plaster so that it will set quickly. In making ready for the work, one should have a strong thread, in the event that the ears are to be cast; as soon as a light layer of plaster is thrown over the face the thread is dipped in the plaster and laid between the eyes, down along the nose, over the end of the chin. When the plaster has been built on from ¼ inch to ½ inch it should be watched closely, and the moment it begins to stiffen he should take hold of the thread and pull it upwards, thus cutting the plaster while it is still soft, making the cast in two divisions. The moment the plaster has set and begins to get warm it should be immediately removed.

It is to be assumed that whoever performs this operation has had some experience in casting; otherwise they should not undertake to do the work. The most painful part is that when the hairs get set in the plaster, it becomes necessary in removing the mold to pull out a few. Hence the reason for double precaution in providing against this possibility.

FREDERICK C. HIBBARD.

* * *

In the work, "Plaster Casts and How They Are Made," by F. F. Frederick, a chapter is devoted to "Casting from Life," from which we quote as follows:

"For a first exercise in casting from life a hand upon a background is suggested. As the work from life is unlike that from inanimate objects the first problem should be simplified as much as possible. Let the hand be closed, the thumb held against the first finger, and placed upon a soft background, that there may be little undercutting. For the background use several thicknesses of cloth or a pillow.

"Roll up the sleeve and wind a handkerchief or towel about the wrist or arm at the desired distance from the hand. With the fingers rub a little sweet oil over those parts of the hand that will come in contact with the plaster. Hold the hand between the eye and the light and if hair can be seen it must be made to lie flat upon the skin, as it would otherwise be pulled out when the mould is removed—a sensation which is said to be unpleasant. If the oil has not body enough to do this a little vaseline or lard can be used, or, as a last resort, the hair can be shaved off. For the comfort of the person operated upon, mix the plaster with lukewarm water. Put a spoonful upon the knuckles and as it runs down blow it well into the spaces between the fingers. Continue with the spoon—do not pour the plaster upon the hand from the bowl. No wall will be necessary, for if the plaster is of the right consistency it will flow but little beyond the hand.

"Amateurs almost invariably make molds from life too heavy in their anxiety to have them strong enough. When the mold is of sufficient thickness the hand must be kept perfectly still until the plaster grows warm in the process of setting. When the plaster grows cooler, in fifteen or twenty minutes from the time it is first put on, the hand with its covering of plaster can be turned over and the cloth pulled off. Any plaster which may have run under the hand can be broken or cut off and the hand easily removed, providing it has been properly oiled.

"As it is very important that the delicate texture of the skin be preserved, the cast

should be made immediately. Fill the mold with water and prepare four strips of clay with which to build a wall upon the background. Or, the plaster being soft, cut the background to any desired shape and prepare a wall of folded paper, which should extend about one inch above the background. Take the mold from the water and place the wall, filling, of course, the open end of the mold. The moment there is no standing water in the mold it can be filled. If the plaster is not fresh it will be necessary to use an oil separation. With a very soft camel's hair brush, go over the mold as soon as the surface is free from water, using the smallest possible amount of sweet oil.

"If the skin is free from hair and it is not desirable to preserve its texture, dry plaster can be sprinkled over the surface which is to be molded to serve as a separation.

"A pleasing variety in the background may be obtained by using cloths of different textures; and accessories, as a coin in the hands, a hand holding a fan, lace at the wrist, etc., add greatly to the interest.

"It is surprising the small space through which a hand can be taken, and this, together with the infinite variety of possible positions, makes casting hands from life a very enjoyable occupation.

"Any part, or the whole figure can be molded in this manner, and casts so made are of great assistance to the sculptor.

"Hands can be cast in the round by either of the methods described elsewhere. Of course, in the first method, the mold will be filled through the wrist, not through a hole made in the mold of the hand. The line of division between the two parts of the mold should come across the knuckles or in as inconspicuous places as possible. If the second method is used, the hand should be dipped several times into the plaster, forming a layer about ⅛ inch in thickness. Hold the hand over the bowl, by resting the elbow upon the table or upon a box, with the fingers higher than the wrist, that the plaster may run down upon the wrist and make this the heaviest part of the mold. The fingers in the cast are very likely to be broken by the weight of the plaster forming the mold—hence the necessity of a thin mold.

"If the hand is closed, as described, the thread will be placed upon the wrist, along the thumb, over the end of the thumb, across the knuckles of the four fingers, from the little finger to the side of the hand, and returned to the wrist. If the fingers are extended the thread would pass across their tips. If the hand is partly closed, or is holding something, two or more threads may be necessary to so divide the mold that the hand can be taken out. If the mold breaks it can be repaired with glue, and if no great pressure is brought to bear against it, will hold together long enough to secure a cast.

"Piece molds from life can be made in much the same way as from casts. No walls will be necessary, for with skillful manipulation the plaster can be made to stay where desired.

"To mold hands, feet, etc., from life is a comparatively simple matter, but to mold the living face is a more elaborate piece of work. It is disagreeable for the person operated upon and may be dangerous if the work is not in skillful hands.

"The person should lie upon his back upon a couch or steamer chair with a cushion under the head. Wrap a towel about the neck, close the eyes, fill the nostrils with cotton, and place a quill or small glass tube in the mouth, or insert a tube in one nostril that the person may breathe. Cover the hair, and especially the ears, that the plaster may not run where it is not wanted. Oil the skin and imbed the eyelashes, etc., in lard or soap. Mix the plaster with warm water, apply and remove as described above.

"Only the best and freshest plaster of paris should be used in casting from life. Mixtures with lime, etc., should be avoided.

"Writers differ upon the value of the cast from the face. One says: 'The value of a plaster cast as a portrait of the dead or living face cannot for a moment be questioned. It must of necessity be absolutely true to nature. It cannot flatter; it cannot caricature. It shows the subject as he was, not only as others saw him in the actual flesh, but as he saw himself.' Another writer of equal authority advances the opposite opinion: 'And after all a cast from the face is hard, forced and unnatural in its character and impression, however skillfully it may be done.'"

This work, which gives much other valuable information about making plaster casts, is published by Wm. T. Comstock Co., 23 Warren street, New York City, and may be purchased for $1.50.

ROCK-FACED WORK—ITS USE AND ABUSE.

The following symposium on the question of rock-faced work in cemetery memorials covers the subject quite comprehensively, and is at the same time both interesting and instructive. A careful reading will disclose the fact that the use of this particular class of finish is confined largely to the smaller monuments. Architectural designs, of acceptable merit, do not, as a rule, permit of this kind of work. It may be considered as an evolution of the rough boulder monument so freely used where rugged and simple effects are sought, but it has, unfortunately, in many cases been made to serve as an excuse for paucity of design and material. And yet, as the subjoined communications show, it has its friends. Its purpose, when used to impart ruggedness and dignity, is a legitimate one, but in the smaller monuments it has undoubtedly been carried to excess. One point has been overlooked in the discussion, and that is the inferior way in which the work is executed in so many instances. Rock-faced work should carry with it the idea of naturalness, yet certainly, in perhaps seven cases out of ten of existing memorials, the rock face has a disastrously artificial appearance, not only in the design of the rock face irregularities of surface, but in the frequent reminders of the skill exercised and expedients adopted to remove the tool marks. The views hereafter expressed should give a better understanding of the question and suggest to the intelligent dealer a middle way.

* * *

I take pleasure in noting some points in regard to rock-faced work, assuming that you mean the use of broken surfaces on ordinary designs in place of hammered work. I recommend the use of rock-faced work in moderation, for the variety it affords in finish, form and color, whether in the different parts of a monument, or contrasted in monuments with and without such treatment.

It is evident that contrast is desirable and rock face properly distributed may be considered as an ornament—the contrast with plain work being the principal function of ornament. Either the amount of rock-faced work or of hammered work should predominate, and the intention should be apparent in the design.

This broken work is more effective in designs above the average size, as it allows of a bolder and freer treatment than in smaller designs, in which it looks less natural on account of the number of small breaks required for a finish. This is noticeable in the strips of rock-faced work on a die surrounding a sunk panel. We often see these strips a mere riband three or four inches wide. We find the same weakness in attempts to make a sunken panel on a name base, the remaining surface looking very scanty. It is best to plan for wider bands or to omit them entirely. A rock-faced monument is more satisfactory with the roof and other washes hammered, if only for the suggestion of cleanliness it gives.

So, then, let your broken surface be proportioned to the hammered work, effectively distributed, and never narrow or stringy in appearance. The breakages should be bold and simple, without too prominent raises or sinkages, avoiding at the same time the monotonous regularity of sea waves. The workman to do this to the best advantage should have in his mind some conception of the finish he wants, and be able to appreciate and take advantage of the accidental breakages.

Its use in connection with carved work should be limited, as they rarely enhance and sometimes conflict with each other. Good carved work suggests refinement, and a hammered ground is more suitable for it. A hammered cross looks well supported on a rough base, but usually rock face is not at home with a good architectural piece of work. Some examples of carving with rough background are creditable for novelty and expertness, but it is safe to say that carving looks best with a tooled or hammered background. If ornamental carving is used with a rough surface, it should be in panels or borders, and separated by moldings.

There is another class of rock work in which are included stones not squared to dimensions, such as rustic crosses and boulders, with or without natural carving. These should be considered differently and by themselves

ALFRED H. COMBE.

The views are so varied as to the utility of rock-faced work that the opinion of one person would scarcely be accepted as a final verdict for or against, therefore your idea of a symposium upon the subject is well taken, and I doubt not but that able opinions will be expressed pro and con,

settling for all time the fate of the class of work under discussion.

For myself, I will say that in the main I am opposed to rock-faced work, excepting under certain conditions, where effect is required which can be obtained in no other way.

Of course, the design should be appropriate and susceptible to the rock-faced treatment, otherwise the critical eye will look upon the creation with abhorrence, and a large measure of condemnation for the architect will escape his lips. Therefore, if the design is appropriate, rock face is admissible, otherwise it should never be attempted.

Mausoleums, properly designed for rock-face finish, look dignified and substantial, but the major part of those persons in quest of memorial buildings are not in favor of rock-faced work, the reason perhaps being that the air of elegance and beauty of lines cannot be obtained. A very good reason, indeed, for who ever saw a beautiful building (or monument) projected on the rock-faced order?

The mode does not come within the purview of art. It cannot be treated or helped on toward anything other than "just what it is"—a mass of rough stones, answering a purpose only, with no hope of improvement, no advance, and generally barred by those of good taste and education.

To rock face for small work I am unalterably opposed, and, for that matter, always have been, and I hold my reasons to be indisputable, viz.: First. The unsightly designs (so-called). Second. Duplication to an unlimited number. Third. The inferior grades of granite shoved onto customers. Fourth. The inferior effect it lends to a cemetery. Fifth, and finally, the complete destruction of those elevated ideas in monumetnal art, so greatly to be wished for.

A rough block of granite will not educate (only in geology), while a finely-finished Corinthian column will, as it appeals directly to the finer tastes, and strengthens the love for the beautiful.

I will point out that one (if not more) of the leading cemeteries of the United States has pronounced against rock-faced work, for various reasons, some of which might be classed among those given above. This action will go a long way toward its decline.

To sum up, it should be used only in thoroughly appropriate designs, and its use is perceptibly declining. It may, in some instances, be combined with ornamental carving, but generally speaking has a cheap effect. It should be absolutely discarded, except as mentioned above.

You have my opinion, and when I say that I have written a contract for but one rock-faced monument in the past forty years, you will appreciate the strength of my opposition. GEO. A. DOUGLAS.

We recommend rock-faced work to a limited extent, where a purchaser has tired of seeing a large variety of memorials having fine hammered surfaces and members, and prefers to show something rugged and dignified as a sharp contrast to surrounding memorial objects. We also recommend this treatment for battlefield memorials, where dignity and rugged effects are sought after, that seem in keeping with the object of the memorial.

We think the sale of this class of work has reached its highest mark, and that there will be a marked decrease in the demand for rough quarry face memorials, at least, in our public cemeteries. We note that in memorial work, like the majority of other branches of business, which admit of a large range of designs and treatments, that the pendulum of trade swings from one extreme to the other. We believe the pendulum for rough quarry face work will now swing backward again for a few years.

It can be combined with ornamental carving to a limited extent, but great care should be exercised in combining the ornamental features with the rustic effects. Oddity does not necessarily mean beauty.

We do not know of any objectionable features of this class of work.

W. B. VAN AMRINGE.

Rock face, in our opinion, should be used very sparingly, and then only when the treatment of the architecture is in harmony.

Would judge that it is increasing from the latest examples in the cemeteries. From all refined designs it should be wholly eliminated.

The treatment of rock-faced work, with ornamental carving is very well and harmoniously blended in examples of Romanesque and Gothic architecture, as the boldness of the rock face necessitates a corresponding boldness in the lines of the carving, and pleasing results are always obtained when the subject is handled by a practiced designer. Otherwise, absurd effects and repelling lines make the treat-

ment destructive of the whole conception.

The objectionable features of this class of work are its indiscriminate use, most of it being overdone, giving a mass of boulder effect, and from its being a dirt catcher, leaving a streaked appearance on the rock, which is marring to the stone and the design.

It is used to best advantage in treatment of the Gothic and Romanesque architecture, in which free latitude is given the designer. It is characteristic of these styles, which should be rugged and bold in the lower sections and tapering to more refined lines as the top is reached. It is essentially detrimental to classic designs, being incongruous with the lines of grace and beauty which these styles demand.

Jos. Pajeau & Son.

Rock face work depends upon several conditions, and perhaps a few hints expressed in a crude way may be of service to the trade if heeded by all parties concerned. In our estimation rock face and boulder work offer unlimited chances to bring out features of beauty and real worth from an artistic point of view, as well as to give the man who has an original idea of real good taste an opportunity to make a dollar.

The constant cut, cut, cut, of stock work is making finished work a harder proposition (to find any margin left as to profit) for all parties concerned, year by year.

The cause of this is patent to all. The very fact that so many people are constantly figuring this work and cutting it cheaper day by day is alone enough to put the salesman where he does not know how to figure to make a dollar for fear the man on the next train has a lower price from some manufacturer on the same job. Well, then, why not use more stuff that everybody does not figure every day in the year, and at the same time give a man who is possessed of good taste the "Something for Knowing How" that he should get.

Every day men grow richer and the very spirit of competition ingrained into the millionaire and multimillionaire's disposition by the acquirement of his wealth will make him buy a high class piece of art if only to beat his competitor on the same line of purchase.

The day is not far distant when, as in all other lines, the machine will be made to cut granite, and cut it dirt cheap at that. It may not be for 10 years, and it is likely to be tomorrow. When that time comes the man without ideas of fine art will be simply part of the history of the industry, the same as the shoemaker who made boots by hand. Poor peoples will get monuments cheaper, but rich people will be looking for something which is not advertised daily at so much a dozen.

The real beauty of rock face work inclines to the artistic rather than the mechanical. It could and should be placed far above the class of work turned out under the hammer and wheel, if the following conditions were strictly observed: To begin with, great care should be taken in the selection of design to fit and harmonize with not only the lot, but the immediate surroundings. Use the various elevations, approaches and even the scenery as embellishments to the design rather than vice versa.

How often do you see a piece of work made hideous by being placed without regard to the above, where it would be a thing of beauty if it were given the proper surroundings.

Boulder work offers an unlimited scope for designs, and the price can be made to suit from a consumer of moderate means to the multimillionaire who considers the sky the limit, provided he gets a piece of fine art and something which will beat his competitor.

Often in a walk through the woods has it occurred to the writer how a certain lot in such a cemetery would be beautifully adorned by the boulder or boulders before him after the skillful hands of workmen could be brought to grasp the situation like unto what nature has done, as it seems for us to copy.

The opportunities for expensive carving or for otherwise imitating such examples of nature in the shapes of stones and vines, etc., as they grow are beyond counting. Nature in all its beauty has full-sized detail constantly on hand. Make your price in accord with your design, consider the customer's ability to pay, ask something for "knowing how" and go ahead.

Now as to rock face work such as is used mostly at present and of which there are so many kinds, what is more abhorrent to the sight than a big square chunk of stone with a square band of square letters set square in the middle of a square lot?

Change the idea, if you will, to a rock boulder or boulders, no matter how shaped (so long as you avoid the everlasting square and leaving the work "just out of

winde," as the cutter says). No matter how they may be set, leave that to the salesman, who knows what the lot is like and what the surroundings will do to make his work look well, and we guarantee that each and every sale will bring out better prices, a new design and a nearer approach to fine art.

Rock-faced work is much abused by the desire to cheapen a design. There are two kinds which look well, but they should not be given away simply because they are rock-face.

Smooth rock-face should in all cases have a clean shoulder and be chipped straight on the same, as well as having a margin line.

Bold rock should have ragged lines, and all axed work should be avoided even to carving and lettering, which should be rustic as far as possible, and avoid all tool marks of any description. If these suggestions were followed closely the much-abused rock face work would be a source of higher revenue to the trade and a thing universally admired by the public.

E. E. Craven.

Rock-faced work in all its variety has generally two sides. I think its application for the lower larger parts of monuments is agreeable, and has a certain charm if not used on small detail parts. Its fitness depends a great deal on the good taste of the designer. I believe rock-faced work will set off the upper cut parts well and make it appear as if the finer finished parts grew out of the lower and coarser elementary work.

For some memorials rock face is very appropriate, and here in the Atlantic States it is used for crosses and other stones fit for its use; also for base courses, window trimmings and keystones for vaults. The olden-time architects have mostly applied it to the lower lines in a moderate way, but I have seen it used in our time above the finished Ashlers, which looks ridiculous.

R. Fischinger.

We do not recommend rock-faced work, and its sale is not increasing in this locality. It should be combined with ornamental carving only in very rare instances, and then in the most artistic manner. It is used to best advantage for foundations, and in some cases for sub-bases. Its chief drawbacks are its bulky, dark and very cheap appearance, especially if placed in a first-class cemetery among or near any high-class and artistically-carved work.

J. S. Clark.

We know of no reason why rock-faced work should not be recommended if people admire it, but we do not think the sale of this class of work is increasing. Ornamental carving with rock-faced work is the proper treatment for ordinary-sized work. Its lack of shape and the opportunities for the collection of dust are the most objectionable features that occur to us. It can best be used, in our judgment, in large dimensions, and should be margined to give it shape.

Rosebrough Monument Co.

Rock faced work can be used with good effect in large masses, but for small work I think it is undesirable, and carving should seldom be employed on it. The tendency in using rock-faced work is to neglect outlines and omit the great care which should always be taken to avoid showing tool marks. It is seen to best advantage in large masses and very simple lines.

C. B. Canfield.

TECHNIQUE OF STATUE MODELING AND CASTING.

The various steps by which a statue is evolved from the clay of the sculptor's model to the final bronze is a vastly interesting process. This description of the process of making a statue in the Scientific American, tells of the evolution of a statue.

When the wet clay is finished and has the lifelike form of the subject, the craftsman prepares to make a mold from the clay. This mold is not used to make the bronze cast, but is employed for making a plaster cast of the clay. From this plaster cast, the final mold is made in which the bronze is poured. To make the mold, the clay is first stuck full of thin pieces of tin, for the mold, when made must be in two or more pieces and some division between the two is necessary. The strips overlap and project six inches from the clay. The clay is then wet down and then covered with a thin, cream-like plaster of Paris mixture, which has been highly colored with some pigment; it makes little difference what color it is, so that it is easily distinguished from white. The reason for this first colored layer is seen later on. The liquid plaster is sprinkled and thrown on the clay statue, the greatest care being taken to cover every part of it completely, and to have the liquid penetrate into all the folds, crevices and indentations of the clay. On the skill and care with which this is done depends the success of the mold.

As soon as this first colored layer has been finished and set, it is built up to a thickness of perhaps an inch with thicker plaster of Paris, uncolored this time. Next, a frame-work of pipes, wood, wire and rods is erected about the statue in such a way that each part of the mold, as indicated by the division lines of projecting tin, has its own set of braces. Once these are in place the making of the mold proceeds rapidly, with an assistant mixing plaster of Paris in a bowl, and the craftsman-caster throwing and kneading the wet masses onto the plaster covering the clay, being particular that the mold is built up the thickest where the most strains will come, where it may be five inches or more thick, and permitting those portions where little strain may come to remain not more than an inch or two thick. The ironrods and pipe frameworks are well embedded in the plaster so that they themselves, will take most of the strain when it becomes time to lift or move parts of the mold.

When the caster is through this part of the work, the whole is allowed to dry or set for at least twenty-four hours, and frequently longer. Next is the important and delicate operation of removing the molds from the clay. The delicacy of the process comes in because the molds do not always "pull," that is, to get the molds off, it is necessary to break the clay and destroy it.

When the various pieces of the plaster mold are all removed, they are cleaned thoroughly of all clay, washed out and finally anointed with a specially prepared grease which will prevent the plaster which forms the cast to be made, from sticking. They are then assembled in place, ready for casting. In a large statue no attempt is made to cast the whole in one piece; the legs and half the trunk form one piece, the head and chest another, the two arms are cast separately, and so on. In order that the several parts should fit one another accurately, the molds are fitted together as the casts are made, and "key joints" are constructed, the raised or "dowel" part of the key being formed on the first cast made while it is still in the mold (and is covered with grease) so that the second cast when made shall form its recess or female part of the joint, this insuring an accurate fit. The pouring of the plaster for the final cast is also a delicate operation. The plaster must not be too thin or it will run away from some parts of the mold and settle in other portions; it must not be too thick, or it will not run into all parts of the mold. The casting must proceed uninterruptedly for each set of molds, or it may not come out a homogeneous mass. Generally, the molds, bound together with rope and wire, are turned about as the plaster is run in, to be sure of getting an even and complete casting. The molds are not filled with plaster, as that would not only make the cast very heavy, but give it an excellent chance to split from strains incident to hardening. The walls of the plaster cast, like those of the mold, are from four to six inches or more thick, but a hollow space is always left in the trunk and legs and arms of such a statue, so that in drying there is plenty of room left for air to penetrate and get to both sides of the cast. When the molds are all cast, and the whole has dried a sufficient time, comes the most delicate part of all—

getting the molds off the cast. For these will not pull from the plaster cast any more than they did from the clay. In this case, however, it is not the cast but the molds which are broken in removing them, and now the significance of the colored layer in the mold becomes apparent for it tells the caster that beneath it lies the cast. The molds are taken off in many pieces and thrown away; their function finished, what remains is a plaster cast, exactly like the original clay, which may be shipped away to the bronze factory (as the clay could not be shipped) there to have molds made in many pieces into which the bronze is finally poured.

Large statues take several days to cast both mold and plaster cast, and at almost any time the labor of months may be spoiled.

The destruction of the clay that the plaster mold may be made, the destruction of the mold that the plaster cast may emerge, like a butterfly from the cocoon, is a delicate operation, and one mistake in the caster's art or one slip of the chisel may mean, if not destruction, at least grave danger to the success of the whole.

HOW TO CONSTRUCT A SUN DIAL.

While much has been written on sun dials it has not usually been in such a vein as to set forth their usefulness to the ordinary intelligence, nor the simplicity of their construction and setting up. The impression, an erroneous one, is common, that they are sort of scientific plaything. In reality under many circumstances and in many situations, they are particularly useful, and far more reliable and accurate, day in and day out, than the average clock.

The fact that the sun dial is intimately associated with scientific consideration imparts to it a particular interest, and has probably maintained for it a particular neglect in the ordinary mind which might well be removed. That it admits of monumental features and may be frequently used in decorative effects greatly adds to its value.

Besides the horizontal and vertical types, which are the most common, there are many other forms, some in very fact curiosities. It is a very old device for keeping the time of day; possibly some kinds were in use over three thousand years ago. The illustrations herewith show three notable examples, and will possibly suggest to the ingenious mind the possibility of designing more varieties and the addition of details to make the shadows cast by Old Sol tell other stories.

The simplest and most popular form is the horizontal dial; the others require some better acquaintance with angles, and necessitate computations, which, while not of serious difficulty, will undoubtedly impair interest in the subject for many readers.

To design a sun dial one must know, or ascertain, the latitude of its proposed location to within a quarter of a degree. This can be obtained in many ways: with a sextant or a transit instrument taking an altitude of the north star; or measured off on any reliable large sized map; or from the office of the Geological Survey, or Coast

TABLE 2.—HOUR ANGLES FOR A HORIZONTAL SUN DIAL AND CHORDS IN INCHES FOR A TEN-INCH CIRCLE.

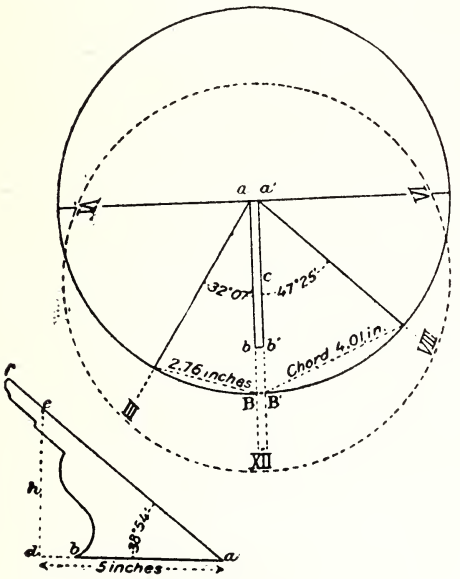
Latitude.	XII-30 XI-30	I XI	I-30 X-30	II X	II-30 IX-30	III IX	III-30 VIII-30	IIII VIII	IIII-30 VII-30	V VII	V-30 VI-30	VI
Degrees.	Deg. Min. 3 11 0.28	Deg. Min. 6 28 0.56	Deg. Min. 9 56 0.87	Deg. Min. 13 43 1.19	Deg. Min. 18 03 1.55	Deg. Min. 22 55 1.99	Deg. Min. 28 51 2 49	Deg. Min. 36 13 3 11	Deg. Min. 45 35 3.85	Deg. Min. 57 37 4 82	Deg. Min. 72 42 5.93	Deg. Min. 90 00 7.07
30	3 46 0.33	7 38 0.66	11 42 1 02	16 6 1.40	21 00 1.82	26 34 2.30	33 06 2.85	40 54 3.49	50 22 4 26	61 49 5.14	75 15 6.10	90 00 7 07
35	4 19 0.38	8 44 0.76	13 22 1 16	18 17 1.59	23 45 2.06	29 50 2.57	36 47 3.16	44 49 3.81	54 10 4 55	64 58 5.37	77 05 6.24	90 00 7.07
40	4 50 0.42	9 46 0.85	14 55 1.30	20 22 1.77	26 16 2.27	32 44 2.82	39 58 3.42	48 04 4.07	57 12 4.79	67 22 5.55	78 26 6.32	90 00 7.07
45	5 19 0.46	10 44 0.94	16 19 1 42	22 12 1.93	28 29 2.46	35 16 3.03	42 40 3.64	50 43 4.29	59 39 4.97	69 15 5.68	79 28 6.39	90 00 7.07
50	5 45 0.50	11 36 1.01	17 33 1.53	23 51 2 06	30 27 2.68	37 27 3.21	44 57 3.82	53 00 4.46	61 36 5.12	70 43 5.79	80 28 6.46	90 00 7.07
55	6 09 0.54	12 23 1.08	18 45 1.68	25 16 2.19	32 09 2.77	39 20 3.37	46 53 3.98	54 50 4 60	63 11 5.24	71 58 5.87	81 53 6.49	90 00 7.07
60	6 30 0.57	13 04 1.14	19 44 1.71	26 34 2.30	33 36 2.89	40 54 3.49	48 28 4.10	56 19 4.72	64 36 5.34	72 48 5.93	81 22 6.52	90 00 7.07

Survey, at Washington, a letter will undoubtedly bring both correct latitude and longitude.

Before any work of construction is begun it is advisable to make a full sized sketch of the proposed dial on paper, which with the aid of the accompanying tables, a pair of compasses and a foot rule or scale, may be readily done. An inch scale divided decimally is preferable, but the thirty-second of an inch nearest the value on the table may be used and will give approximate accuracy.

For a horizontal sun dial the angle at the foot of the gnomon, or stile (the triangular vertical member which makes the shadow) equals the latitude of the place and directions for laying it off are given as follows in the Scientific American:

To plot the gnomon or stile: Draw the line a d (Fig. 1) 5 inches in length, and at one end erect a perpendicular d e, the height of which is found from Table 1,



direct, or by interpolation when necessary for the given latitude. For example, latitude 38 deg. 54 min. (Washington, D. C.), the height 5/6 of a degree greater than for 38 deg. The difference between the tabular value for 38 deg. and 40 deg. is 0.29 inch, or say 0.15 inch for 1 deg. or 0.12 for 5/6 degree, 3.91 plus 0.12 = 4.03, the height required. Connect the points a and e. The angle d, a, e = 38 deg. 54 min., and is the correct angle for a stile at the given latitude. The sides a, d, and a, e, may be extended or cut short, and the back of the stile made of any shape desired. The length of the shadow line a, f, should be about three-fourths the diameter of the proposed dial.

To lay out the hour circle: Draw the parallel lines a, b, a', b', representing the base of the stile in length and thickness (for ordinary metal stiles this should be from ⅛ to ⅜ of an inch). With the points a, a' as centers and with a radius of 5

TABLE 1.—HEIGHT OF STILE IN INCHES FOR A 5-INCH BASE FOR VARIOUS LATITUDES.

Lat.	H.	Lat.	H.
Deg.		Deg.	
25	2.33	44	4.83
26	2.44	46	5.18
28	2.66	48	5.56
30	2.89	50	5.96
32	3.12	52	6.40
34	3.37	54	6.88
36	3.63	56	7.41
38	3.91	58	8.00
40	4.20	60	8.66
42	4.50		

TABLE 2.—CORRECTIONS IN MINUTES TO CHANGE SUN TIME TO LOCAL MEAN TIME. ADD THOSE MARKED +, SUBTRACT THOSE MARKED —, FROM SUN DIAL TIME.

Day of Month.	1	5	10	15	20	25	30
January	+ 3	+ 5	+ 7	+ 9	+11	+12	+13
February	+14	+14	+14	+14	+14	+13	
March	+13	+12	+11	+ 9	+ 8	+ 6	+ 5
April	+ 4	+ 3	+ 2	+ 0	— 1	— 2	— 3
May	— 3	— 3	— 4	— 4	— 4	— 3	— 3
June	— 3	— 2	— 1	+ 0	+ 1	+ 2	+ 3
July	+ 3	+ 4	+ 5	+ 6	+ 6	+ 6	+ 6
August	+ 6	+ 6	+ 5	+ 4	+ 3	+ 2	+ 1
September	+ 0	— 1	— 3	— 5	— 6	— 8	—10
October	—10	—11	—13	—14	—15	—16	—16
November	—16	—16	—16	—15	—14	—13	—11
December	—11	—10	— 7	— 5	— 3	— 0	+ 2

ins. describe semi-circles, as shown. Where these intersect the lines a, b, a', b' (extended if need be), will be the 12 o'clock points. A line at right angles to the base of the stile through the points a, a' will be the 6 o'clock line. Intermediate hour and half-hour lines can be located by laying off the chord distances from Table 2 for the given latitude, to the right or left from the 12 o'clock points B and B'. For example, latitude 38 deg. 54 min. and 9 A. M., or 3 P. M., the tabular value for 35 deg. is 2.57 inches, for 40 deg. it is 2.82 inches, difference 0.25 inch, hence for 1 deg. it is 0.05 inch and for 54 min (5/6 deg.) 0.04; therefore, for 38 deg. 54 min. it will be 2.57 plus 3 times 0.05 plus 0.04 = 2.76 inches. In the same manner other hour or half-hour points may be located on the semi-circles having a and a' as centers. The 5 A. M. mark and the 7 P. M. mark are the same distance from the 6 mark as the 7 A. M. and 5 P. M. points. Having fixed the positions for the half hours, the ¼ hour and the 5 or 10 minute marks may be computed or spaced in by eye. Lines joining each of the hour of

minute marks with the center a or a′ will give the hour of time lines.

If a good protractor, an implement in constant use by draughtsmen for laying off angles, is available, the hour and half-hour points can be found by laying off the angles taken from the table for the given latitude from the points a and a′ as centers, remembering that the angle to the 12 point is 0 deg. and to the 6 point is 90 deg. If it is desired to make the sketch on a larger or smaller scale, the radius of the semi-circles and the chord distances should be changed in the same proportion, but the angles between the base of the stile and the various hour lines must not be changed, whatever the shape of the dial plate may be. Since the hour lines are closer together near the 12 points than near the 6, it is customary to extend the former to a circumference of some other circle the center c of which is midway between the lines, a, m, and a′ b′, the distance a, c, may be about 1/5 the diameter of the proposed dial. The outside of the dial plate may be of any fanciful design, provided that the hour points always fall on a radius or extended radius of the circle first drawn.

The design completed, next comes construction, and the simplest will naturally be in wood, with the hour marks printed in or otherwise designated, at the pleasure of the constructor. A more substantial idea for the amateur will be a sun dial constructed in cement and small field stones, the hour and time marks being carefully cut in the face of the cement dial by a knife before it hardens. The gnomon, or stile, may be made of bronze or brass; it is sometimes made of stone, but the metals are much better.

When placing the dial in position great care should be taken to make the hour circle truly horizontal or level, and to place the plane of the gnomon at right angles to the dial face. The 12 o'clock line must lie in a vertical north and south plane, and the sloping side of the stile (the shadow line), must point as nearly as possible toward the north pole. If the magnetic declination be known a compass needle will enable one to properly set the stile. When the north star is visible from the point selected for the dial suspend a plumb line 8 or 10 feet to the north, and in line between the selected point and the north star when on the meridian, i. e., when the double star in handle of the Dipper is vertically over or under it; then fix the sloping side of the stile so as to point to the plumb line, and it will be in proper position.

Table 3 gives the corrections for selected dates for the difference between sun-time and mean, or clock time. In November the clock is slow; in February the sun is slow. Four times a year, April 16, June 15, September 2 and December 25, the difference between mean and apparent time is zero. On those dates the readings on a sun dial need no correction. In table 3 the difference for dates not given may be found by interpolation with an error not exceeding a minute at any time.

The sun dial is a suggestive object for the attention of the monument dealer. As ornamental and at the same time useful and instructive features in cemeteries, parks, city squares, fine private gardens and public buildings, they should be far more frequently seen than they are. It is quite probable that no single object that can be secured at such cost as will meet all conditions, will afford the lasting interest of a sun dial; and the designing of them gives food for thought and ingenuity, a combination always absorbing.

WATERPROOFING MONUMENTS AND STONE WORK.

The following are some hints on the waterproofing of monuments, vaults, mausoleums, etc.:

"There are a few principal points to be remembered in the subject of waterproofing: First—What material is best as a permanent damp or water register? and from our experience we would recommend a permanent waterproofing.

"Second—How is the waterproofing agent best handled? There are two methods of handling for the purpose of waterproofing: through the natural law of heat absorption, and through the carrying agent.

"In treating the subject of waterproofing for cemeteries for the protection of different vaults, mausoleums, etc., against moisture, with which all cemeteries are troubled, it is advisable to incorporate the high test paraffine into the pores of the different stones through heat. The stone first has to be treated mechanically to the required temperature, and the paraffine in a melted condition is applied over the heated surface, and is immediately carried into the stone. The amount of heat penetration is controlled entirely by the depth of the heat line, and this is always governed entirely by the texture and porosity of the stone.

"By applying the mechanical method as stated, the heat serves to thoroughly dry out the stone, and this is the most important factor, for it is realized by all engineers and people who are conversant with this subject, that no effective waterproofing can be done on a wet or damp surface; for while the moisture is being drawn out, no paraffine will be absorbed, and this process must continue until the required amount of paraffine is taken in, so that no gloss remains on the outside of the stone. Nothing but pure high test paraffine must be used and each and every pore must be filled to a depth of from one-eighth of an inch in marble to one-half inch in the coarser textures.

"In stones which have rough surface or where the surface is to be left visible to the effect of the filling or treatment, it is necessary to apply a further mechanical process of removing all traces of the waterproofing from the exterior surface of the stone, and this can be accomplished by the sand blast method of removing the film or grease marks, leaving the stone in a natural finished condition.

"It is possible by this method of paraffine application to treat all classes of vaults and mausoleums which are comprised of different stone textures; taking in all relief work, fancy designs, cutting out letters, and guaranteeing the stone permanently against moisture, without changing the color of the stone. Vaults which have been thus treated will last many years, and this method of waterproofing will do away with the odor of dampness which is generally found in cemetery vaults, due to the fact that the stone, in the course of construction, is never waterproofed and is generally banked up by earth and grass on all sides of it, which naturally causes the dampness due to rain or other climatic conditions, especially in the eastern section of the country.

"From experience it is found that in attempting to waterproof an exterior wall it is necessary to go to the source of the trouble, or in other words get to the back of the wall. The walls of many structures are damp-proofed on the inside during construction. What becomes of the exterior, which is exposed to the weather, and the lime, mortar and cement joints, where the brunt of the weather is concentrated on the building? The walls are left to the mercy of dampness, as well as freezing and thawing, and nothing is done to overcome the evil."

The difficult problem of waterproofing buildings, mausoleums and other stone work has frequently been discussed and several systems and preparations described.

Edw. M. Caffall describes the Caffall system of exterior waterproofing as follows:

The treatment of the exterior of a building to render it permanently and effectively waterproof demands not only the material and the process, but the knowledge of the characteristics of the object to be treated on the part of the operator as well. A stone long exposed to the weather cannot be waterproofed in the same manner as a stone newly taken from the quarry, though there is a principle underlying all operations which is the same in every case.

It will be seen that these remarks do not apply to the superficial washes, or mixtures of so-called "waterproofing," so widely advertised. None of them claim to be permanent, and therefore none of

them are effective. There is only one permanent, effective waterproofing process.

The clearest evidence that can be brought to show the truth of the above statements has been recently furnished by the London, England, authorities.

The obelisk on the Thames Embankment (Cleopatra's Needle) has been treated every year for thirty-one years with a "preservative waterproofing" compound of the same nature as the above-mentioned widely advertised coatings. This year the condition of the "Needle" has become so alarming that they are seriously considering removing it at once to the interior of the British Museum, to keep company with the two Egyptian obelisks already there.

This unfortunate stone, notwithstanding its frequent annual protective "waterproof" coatings, presents the appearance of a dilapidated factory chimney. Vastly different is the condition of its sister obelisk in Central Park, New York. Though standing for thirty years in the extremely severe New York climate there is no anxiety or alarm in the minds of its custodians. It costs absolutely nothing to maintain its clean, smooth and beautiful appearance, and this is a puzzle to Londoners.

Why should there be such a striking difference in the condition of these two obelisks?

In 1885 Robert M. Caffall was engaged by the Department of Parks to apply the "Caffall Process for Waterproofing" to the New York obelisk. For the succeeding 25 years that stone has towered aloft on its eminence in the Park, defying the elements which attack it on all sides. Frost, rain, the sun, gases, smoke and the wind strive vainly to affect the stone, in spite of the fact that the obelisk had been left unprotected for four years after its erection in the Park and seriously damaged thereby.

Moreover, the protection afforded by the process is still effective. There is no known reason why it should change during the next 25 years. Even lightning cannot strike the shaft, owing to the non-conductive properties of the materials used.

Here, then, is an example of effective, permanent exterior waterproofing contrasted with the feeble, ephemeral "waterproofing coatings" which have been thus demonstrated to do absolutely more harm than good. Money is worse than wasted in their purchase and use.

The reader must bear in mind the difference between underground waterproofing (the pitch, asphalt and tar paper system) and the exterior, above-ground wall waterproofing. They are not the same, though in principle akin.

Of more recent date, and illustrating the opening remarks, is the treatment of the Italian fountain in the New York Zoological Park (Borough of the Bronx). This beautiful object stood for eight years between the primate house and the site of the new administration buildings. Last year it was determined to remove it, at great expense, to the center of the Concourse. While being erected in its new location it was treated with the Caffall process for waterproofing. Those who remember it in its old location will appreciate now the benefit conferred on the stone by its treatment. Some of the stones were completely shattered by dampness and frost.

Hundreds of buildings of every kind of building material and ranging from the tenement to the mansion have been treated by this process and rendered permanently dry and sanitary. Some date back to 1879. All are still good and sound, according to all external evidence.

It is a strange feature of our average modern construction that property owners and architects seldom make provision for the protection of stonework or brickwork from the weather when designing a building, notwithstanding the evidences on all sides of the damage wrought by the weather in a short space of time (even ten years). All iron and woodwork is given at least three coats of paint, and thereafter every three or four years this iron and brick are neglected until the water begins to penetrate into the building, and even then is tolerated as a necessary evil.

HELPFUL HINTS FOR THE HANDY MAN

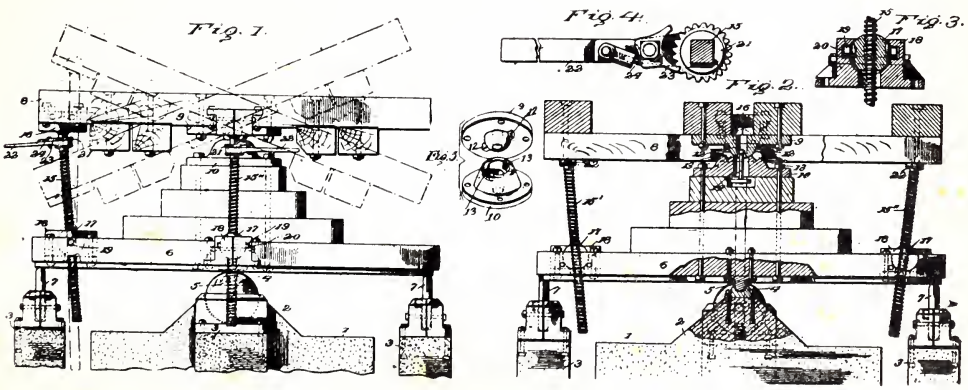
Alphabetically Arranged.

PATENT MOVABLE AND ADJUSTABLE STONE "BANKER."

George A. Cross, of the firm of Cross Brothers, Northfield, Vt., has been granted patent No. 1,007,540 for an improved method of bankering stone which is designed to provide a support or table for holding stone when being worked which will be capable of easy and ready adjustment for bringing any side of the stone to the position or angle desired, thus obviating the necessity of using a derrick each time the stone has to be moved.

In the accompanying drawings, Fig. 1 is a view in front elevation showing various positions of the supporting platform indicated in dotted lines. Fig. 2 is an end elevation. Fig. 3 is a section view of one of the adjusting rod connections for the platform. Fig. 4 is a plan view of the means for operating the adjusting rods. Fig. 5 is a view in perspective of the bearing for the table.

Referring to the drawings, 1 designates a base which forms a central supporting member 2. Adjacent to this base are side supports 3. The central member is shown as cone-shaped and on its apex is fitted a socket plate 4 designed to accommodate the ball member of a plate 5 mounted on the underside of a rotatable platform 6. This ball and socket forms a pivot upon which the platform turns and by which it is supported. Upon the supports 3 are mounted roller bearings 7 for maintaining the platform in a true, horizontal position in the event of weight being placed more on one side than on the other. This platform C is circular in plan view, and upon it are bolted a series of blocks in pyramidal formation and forming the support for a table 8, upon which the stone sets. The table is connected to the platform by a ball and socket joint, made up of upper and lower plates 9 and 10, attached respectively to the table and the platform. In order to prevent the table from being rotated on the platform 6 the ball member of plate 9 is formed with lugs 12 which fit in cut-outs 13 in plate 10, the walls of such cut-outs acting as stops for the lugs 12. To prevent accidental disengagement of the table, a bolt 14 is passed centrally through bores in the two plates 9 and 10.



The tilting of the table 8 is accomplished by means of screw rods 15, 15′ and 15″, two of which 15′ and 15″ are set at diametrically opposite points on the table and in alignment with the pivot of the table, while the third, 15, is positioned at about 90° to form a means for adjusting the table on one side. Each screw rod is connected to the table by a ball and socket joint 16, and to the platform by an oscillating ball-like nut 17 mounted in a housing 18 in the platform. The turning of one of the screw rods 15 in the nut 17 will cause the table to change its angular position relative to the platform. From the ball-like nut 17 project two lugs 19 which fit within cut-outs 20 in the housing 18 to prevent lateral movement of the nut when the screw rod 15 is actuated.

In order that the screw rods may be readily turned to adjust the position of the table each is provided near its top with a ratchet wrench comprising a ratchet wheel 21 and a lever 22 carrying a double spring-actuated pawl 23. By manipulating the lever, a pin 24, operating in a groove in the pawl 23, engages one wall thereof and causes the pawl to engage the teeth of the ratchet wheel. The motion may be reversed by changing the location of the pin, as is usual in the greater number of wrenches of this type.

In operation, the stone to be worked upon is placed on the table by a crane or other carrying means and the table is adjusted to any angle by the turning of the lever or levers 22 which effects the turning of the rod 15 or rods 15′ 15″ the ball connections of the rods with the table permitting any movement desired. There are three of these screw rods by which the table may be adjusted in any position. By operating rod 15, one end of the table is forced up and the other end down, or vice versa, or by manipulating all of the rods, as previously described, the table may be tilted cornerwise. Then, again, by turning the rods 15′ and 15″, the table may be tilted sidewise, in either direction.

MAKING CAST OF CARVING.

Can you tell me some of the best methods of making plaster casts of carving on monuments in the cemetery? One often has to duplicate the carving of a job standing in the cemetery, and the only way is to have a working model or mould, as a drawing will not answer where the duplicate must be exactly as the original. In foliage carving of high relief the plaster gets in under the leaves. Now, how is the best way to get it out without breaking the mould? Your help will be greatly appreciated—J. R., Pa.

Where it is required to duplicate the carving on a monument already erected, it can be done without difficulty by a professional plaster moulder, as it would be inadvisable for one to do it who never did any plaster piece mould casting or glue or gelatine casting. If the model to be copied has many under-cuts and it is complicated, I suggest a gelatine mould. A gelatine mould, however, has the inconvenience of having to melt the gelatine close to the spot and get it there before it gets too cold before pouring it into the shell of plaster made around the model. A piece mould is more practical if the undercuts are not so deep and complicated. Any good plaster caster knows what to use over the granite or marble to prevent the plaster or the gelatine from sticking. Castile soap is generally the best, while good olive oil could be also used on marble without leaving any stains; but the man must know how to use it, and I would not advise any green hand to undertake such a delicate work, lest he might injure the model.

POMPEO COPPINI.

* * *

I really would not feel like recommending anyone to attempt to take a plaster model of the carving on a monument unless he had a great deal of experience in making plaster models. There might be a danger of spoiling the carving, so the only advice that I could give would be to get a professional plaster caster to do the work. I would not attempt to explain in writing to an inexperienced person how to make such a cast, knowing in advance how easy it is for one to misapply instructions and possibly do damage or get poor results.

FREDERICK C. HIBBARD.

CEMENTS FOR VARIOUS USES.

Recipes for Cements, Plaster and Varnish.

A desire to always be up to date is the reason Felix G. Pulford, of Baltimore, Md., commenced keeping a note book of the following valuable receipts, taken from the practice of some of the best men in the trade:

Keating's Cement (1849): Calcine a mixture of equal parts of Borax and Plaster of Paris and reduce to a fine powder. This is an excellent substitute for Plaster of Paris, and requires less water in the mixing. Neither does it set as quickly.

Keens Marble Cement: Compounded of equal parts of Plaster of Paris, alum and any alkaline compound.

Scagliola: Calcine and powder pure gypsum and mix with glue, isinglass, or other gelatinous body with the color (painter's) desired. The different colors are combined and floated into the mould as desired. The hardened work is rubbed with pumice and sponged. As final touches the work is polished with Tripoli earth and pure charcoal, followed by Tripoli and oil and finally with oil alone.

Common Solder: To two pounds of melted lead add one pound of tin.

Hard Solder: To two pounds of melted copper add one pound of tin.

Soft Solder: To one pound of melted lead add two pounds of tin.

Fusible Alloy: Melt in boiling water four ounces of bismuth and add 2½ ounces of lead and ½ ounce of tin. Or, melt in the same manner one ounce of tincture of bismuth and one ounce of lead.

Wood Cement: A useful cement for rendering foundation boxing, or casket boxes, impervious to water is prepared by calcining separately equal parts of lime, clay and oxide of iron. The parts must be kept in separate vessels until ready for use, and then mixed to the consistency of paste and applied with a trowel or stiff brush.

Marble Cement: Add equal parts of loaf sugar and slackened lime to boiled arrow root until the mixture forms a stiff paste.

Plaster Varnish: An excellent varnish for plaster figures is made by fusing ½ ounce of tin with the same amount of bismuth and adding to the result ½ ounce of mercury. Before applying the figure should be brushed with the white of an egg.

Best Cements: For stone work: One part cement and three of sharp sand. For Brick Work: One part cement and two of sand. For Concrete: One part cement, three parts sand and three of crushed building stone. If used for foundations the concrete should be mixed with as little water as possible and left for 48 hours before weight is added.

Marble Cement: Bake a saturated solution of equal parts of Plaster of Paris and powdered alum and grind to a fine powder. This is mixed in a cement as wanted. The composition sets very hard and will take a high polish. It may be mixed with any mineral color to correspond with that of the stone to which it is applied.

Plaster Hardener: Calcine a saturated solution composed of equal parts of alum and gypsum and reduce to a powder which is mixed with the plaster in quantities sufficient to bring about the degree of hardness desired.

CEMENT FOR POINTING JOINTS.

For making a cement for pointing the joints of monuments the following formula is recommended:

Take dry white lead, mix it with a good quality of varnish, use dry coloring matter to produce the color required. This is to be mixed with a hand hammer, and the more it is worked, the better it gets. Should it dry up, it is all the better after being mixed the second time, and it will keep for several days in air tight dish or in water. In cold weather it needs to be warmed before using.

SPECIAL PURPOSE CEMENT.

The value of a cement is, first, that it should become a strongly cohering medium between the substances joined; and, second, that it should withstand the action of heat, or any solvent action of water or acids, says the *National Builder*. Cement often fails in regard to the last consideration. For waterproof uses several mixtures are recommended, and the following may be mention: One is to mix white lead, red lead and boiled oil, together with good size, to the consistency of putty. Another is one ounce of powdered resin dissolved in ten ounces of strong ammonia, and five parts of gelatine and a one-part solution of acid chromate

of lime. Exposing the article to sunlight is useful for some purposes. A waterproof paste cement is said to be made by adding to hot starch paste half its weight of turpentine and a small piece of alum. As a cement lining for cisterns, two parts each of powdered brick, quicklime and wood ashes made into a paste with boiled oil is recommended. The following are cements for steam and water joints; Ground litharge, ten pounds; plaster of Paris, four pounds; yellow ochre, one-half pound: red lead, two pounds; hemp cut in one-half inch lengths, one-half ounce, mixed with boiled linseed oil to the consistency of putty. White lead, ten parts; black oxide of manganese, three parts; litharge, one part; mixed with boiled linseed oil. A cement for joints to resist great heat is made thus: Asbestos powder made in a thick paste with liquid silicate of soda. For coating acid troughs a mixture of one part pitch, one part resin and one part plaster of Paris is melted, and is said to be a good cement coating. Correspondents frequently ask for a good cement for fixing iron bars into stone in lieu of lead, and nothing better is known than a compound of equal parts of sulphur and pitch. A good cement for stoves and ranges is made of fire clay with a solution of silicate of soda. A glue to resist damp can be prepared with boiled linseed oil and ordinary glue, or by melting one pound of glue in two quarts of skimmed milk; shellac, four ounces; borax, one ounce; boiled in a little water and concentrated by heat to a paste. A cement to resist white heat may be usefully mentioned here: Pulverized clay, four parts; plumbago, two; iron filings free from oxide, two; peroxide of manganese, one; borax, one-half; sea salt, one-half; mix with water to thick paste, use immediately, and heat gradually till it comes nearly to a white heat.

CEMENT FOR SETTING MONUMENTS.

The way to mix cement for setting granite, as I have used it for 15 years, is to use dry white lead and mix it with varnish. Copal varnish is nearly free from oil. Mix it the same as you would dough. When you are ready to use it, take a piece and roll it in a string on a board. Use the palm of your hand. Make it as long as you wish, like a worm, and place it on the base and let the end lap over. Then when the die comes down on it it will crush out. Trim with a knife when the job is set.

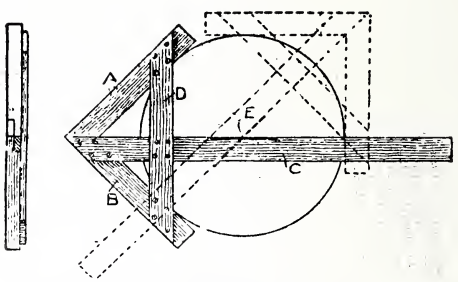
W. J. Kemp.

I note it is recommended to make a cement to set granite monuments by a mixture of white lead and marble dust. This mixture will stain a stone, which stain will travel up until absorbed. The following is a mixture which the writer has used for a number of years, which will not stain the stone: Take dry white lead, mix it with a good quality of varnish, use dry coloring matter to produce the color required. This is to be mixed with a hand hammer, and the more it is worked, the better it gets. Should it dry up on you, it is all the better after being mixed the second time, and it will keep for several days in an air-tight dish or in water. In cold weather it needs to be warmed before using.

Oliver H. Leaman.

TOOL FOR FINDING THE CENTER OF SHAFTS.

The center of a shaft, a round casting or a large round object may be easily found with the tool shown in the illustration, which is from *Popular Mechanics.*



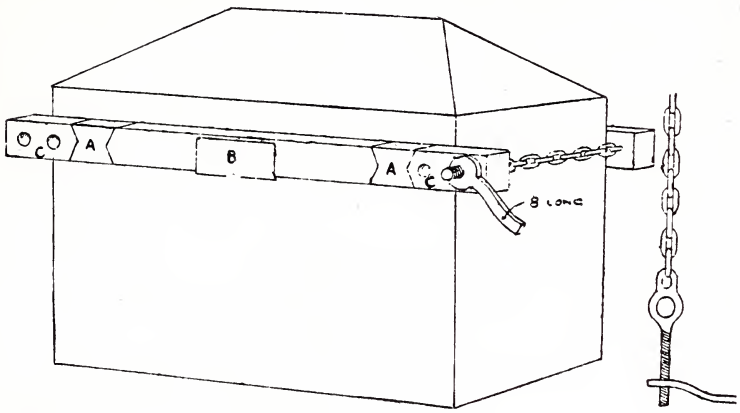
FINDING CENTER OF SHAFT.

To make it, nail together two pieces of board, A and B, so that they form a right angle, and fasten a long piece, C, so that one of its edges bisects this right angle, a brace, D, being nailed over the three pieces to insure rigidity.

Lay the device on the end of the round object with the right angle drawn closely to the circumference and then draw a line along the edge of the long piece C. Move it to another position and draw another line. The intersection, E, of these two lines will be the center of the object.

HANDY CHAIN DIE SETTER.

We enclose sketch of a handy die setter which has the advantage of using a chain instead of long bolts. The chain is readily adjustable for dies of any thickness. We have used this style of setter for many years and have not heard of any others in use. The chain may be fastened solid to one bolt and the other end of the chain left loose, so it can be passed through the eyebolt to lengthen or shorten for dies of any thickness. Use eight-inch handles on all corners for tightening. B is a steel plate for horn or jack. CC are holes for chains for different length dies. Rubber pads or heavy water hose may be used to protect die. The bolts with handles on them should be ¾ inch thick and ¼-inch chain should be used.



HANDY CHAIN DIE SETTER.

DeArmond & Root.

CHANGING NAMES ON A PHOTOGRAPH.

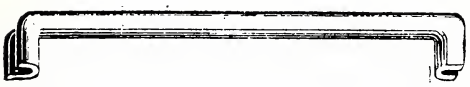
A great many times monumental firms have a photographic design that a customer likes and the salesman thinks that by having the same design made over on a larger scale with the customer's name drawn on it a sale can be made. One can by the following process execute on the original photograph the necessary drawing of another name or other corrections one might desire to make. Purchase one tube of opaque white. Chinese white is the name of one make that is good; that is used with water. Have one small water color brush and squeeze some white out of the tube into a small dish; add a little water and mix with the brush; keep the mixture thick. A photograph has a very smooth surface that is a little oily, and you can not work on it until it is prepared. To prepare it rub some talcum powder over the letters and other places you want to draw over and it is ready to receive the water color. Take a brush full of the white and draw over the letters. It will be necessary to go over this surface with the white several times until it is sufficiently covered. This will dry in a very few minutes and you can then draw the letters upon this white part wanted at the time. To insure neatness draw the letters on a piece of thin paper and transfer them to the photograph. Then restoring the remaining part of the white to the original color is easily accomplished by using lamp black, which is bought in the tube form like the white. Mix very thin with water with the brush which has been thoroughly washed with clean water to get off all the white. Put the dark tone around the letters. Should one tone not be sufficient add another one until the value is like the surface around it. A 6 H lead pencil will help a great deal. After sharpening to a fine point work over all spots that are too light. To make the letters stand out and look raised use a 3 B pencil and draw their shadows. Carving can be changed in this manner and any photograph can be strengthened by using white in some places and dark in other places. This paint must be removed from the photograph after the sale is made and be restored to its original form. This is done with a good silk sponge dipped in clean water. The paint will immediately wash off and the photograph is as it was before.

FIXING CHARCOAL DRAWINGS.

To fix charcoal drawings so they will not rub off a thin varnish known as "Fix-abit" is used. It is sprayed on drawings by use of an atomizer. Any artists' supply houses can supply it.

CLAMP, FRENCH, FOR STONE-WORK.

Every marble-worker knows what trouble the clamping together of the various pieces of his work gives him. The usual hooks or clamps are made of copper or iron rod cut off from the coil to the required length, as occasion calls, and bent up at right angles at the two ends; and the holes in the marble are made as best they can be. To make the clamp exactly long enough to suit the distance between the holes, or vice versa, does not always prove so easy; and then there is the



FRENCH CLAMP FOR STONE WORK.

question of the depth of the holes, which should agree with the length of the bent-over portions of the rod—and even these are not always alike.

The French marble-workers, however, use ready-made clamps of rolled steel, which are more durable than the home-made, and are said to save time. The turned-up ends are grooved on their outer sides, so that they have a section as shown in the annexed cut.

There are on the French market 13 sizes of these clamps from 40 to 100 millimeters (1.6 to 4 inches) in length, in steps of 5 and 10 mm.; and they are true to their nominal dimensions, and all the bent-over ends are exactly 7 mm. (0.28 inches) long. All require grooves exactly 9 mm. (0.38 inches) wide and 1½ mm. (0.06 inches) deep, in case they are to be sunk in; so that the marble-worker need have only one sample of each size at hand, in order to make all the holes and grooves. In facade work, for colored marble, ordinary steel clamps are used; for white marble, however, they are tinned. Experiments with clamps of "galvanized"—that is, zinc-coated-rod, showed that in bending the zinc flaked off and left the iron bare, causing rust spots on the marble; so that if zinc coating is used it must be done after the rod is bent. 100 clamps 65 mm. (2.5 inch) long, weigh about a pound and a half, and cost about a fifth of a cent each. For cemetery work there are stouter clamps of this type.

MARKING CIRCLES ON A STONE.

When there is a large circle to be marked on a stone it is often a problem how to accomplish it. When there is no

USING STRAIGHT EDGE FOR COMPASS.

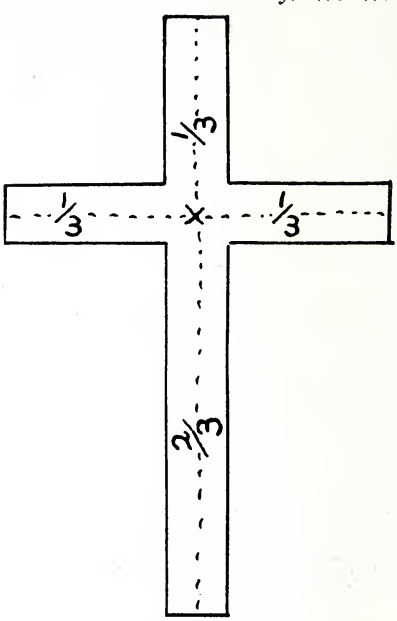
compass large enough a long, straight edge can be made by driving a nail into one end, this to be used to scratch with. Also drive one at the required radius distance. A perfect and completely made circle is the result. For instance, when one has a different radius, such as 4 feet, 6 feet, etc., all that has to be done is to drive nails, the required distance and mark the stone. Illustration here shows the proper way to use this system.

PROPORTIONS FOR CROSS.

Will you please explain and illustrate the right proportion for tracing or cutting a plain cross?—T. C., S. D.

The proper proportions of a cross are as illustrated. The three arms at the top are measured as one-third from the center of the cross arms. The down part of the perpendicular arm below is measured as two-thirds. One will always have a well balanced cross by using this system.

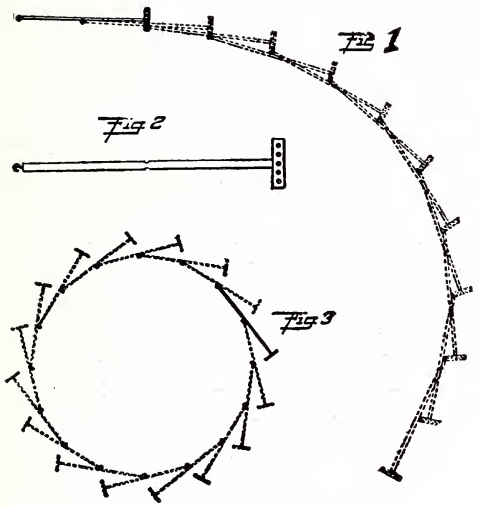
J. W. W.



SHOWING PROPORTIONS OF CROSS FOR DECORATION.

LAYING OUT A CURVED WALK.

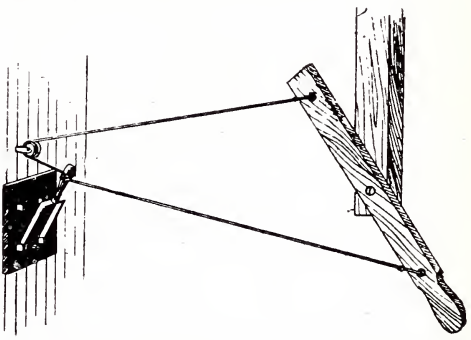
It is no small task to lay out a walk with irregular curves and have the curves graceful. Unless the work is carefully done, an angular effect will be produced which will spoil the appearance of the garden or lawn through which it runs. A very simple implement may be devised out of a stick with a crosspiece, with which one can transfer curves that are carefully drawn on paper, to the walk itself. Two implements will be required, one for use on the lawn, and the other of smaller dimensions for use on the drawing table. As indicated in Fig. 2 of accompanying drawing, the implement is provided with a hook at one end, while several holes are bored through the crosspiece. The rod is also notched at the center. A pin is stuck in the paper at one end of the curve. The rod is hooked over this pin and a second pin is stuck in the paper opposite the notch in the center of the rod. A third pin is now driven through the hole of the crosspiece under which the curve runs. The next step is to hook the device over the second pin, rest the notch against the third pin, and insert a fourth pin through the crosspiece at the point where it intersects the curve. Proceeding in this way, a series of pins are placed in the paper along the curve, and opposite each is indicated the number of the hole in the crosspiece through which it was inserted. Now, taking the large implement, the same curve can be reproduced to actual working dimensions by driving pegs in the ground through the holes specified on the drawing. In the case of an abrupt curve, or if it is desired to lay out a circle, as in Fig. 3, the crosspiece may not be found long enough, but the distance of the crosspiece from the curve at each step may be transferred from the working drawing to the actual work.



LAYING OUT A CURVED WALK.

EXTENSION HANDLE FOR SWITCH.

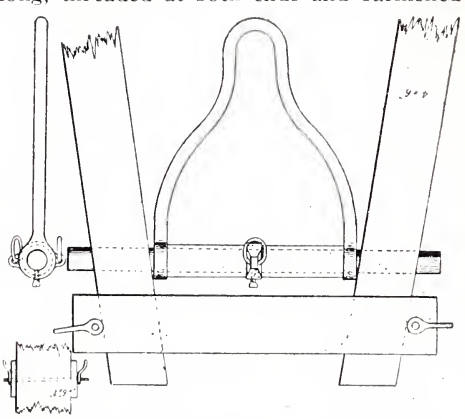
As in many shops the switch for the motor is in an inconvenient place, a device similar to the accompanying illustration can be easily constructed at any convenient place in the shop. A 2x4 upright should be securely attached to the ceiling, and by using an inch board for the handle and attaching it onto the 2x4, so that it will swing easily, and then by using a heavy chalk line to run to the switch, we have a device that will save lots of steps. One line should run through a pulley attached to the wall.



EXTENSION HANDLE FOR ELECTRIC SWITCH.

A HANDY DERRICK.

A handy derrick designed and used for many years by W. J. Mattern, North Topeka, Kans., is constructed as follows: It is constructed of two 14 or 16 ft. hard pine timbers 4 in. by 6 in., clamped at the top by two pieces of hard pine 2 in. by 6 in., through which ½ in. bolts 1 foot long, threaded at both ends and furnished



SHOWING CONSTRUCTION OF CLEVIS.

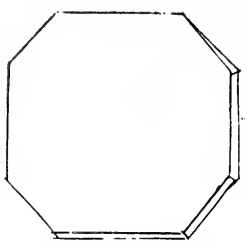
with tightening handles, are passed. These handles are made to be turned by hand for speedy work. About one foot from the top of these timbers and at the proper angle 1⅝ holes are bored, to hold the soft steel bar, 1½ in. diameter by 2 ft. 2 in. long, which carries the clevis, etc. The clevis is made of 1 in. iron and has a hang of about 16 in. in the clear; it is kept open on the bar by a 12 in. piece of 1⅝ in. pipe and over this pipe a collar is fitted, held in place by a set screw, which has on each side loose rings through which the guy ropes pass. The sketch will make the construction clear.

Any portable hose can be used with this derrick. Mr. Mattern uses for his guy ropes double and single blocks with ¾ in. rope. Stones weighing 8,000 pounds have been handled with this apparatus, and the derrick can be set up for work in ten minutes.

With a three mile trip to cemetery with two men, three pieces of work weighing 10,000 pounds have been set, the derrick erected and taken down and the outfit brought back again to the shop before 12:30 dinner time. For facility of handling this little derrick is worthy of notice, and its cost is comparatively small.

MAKING EYE GLASS LENSES.

Very often the lenses of a workman's glasses get so spotted by the constant hitting of granite and steel while he is working that they become blurred and he can



SHAPE OF LENS GLASS BEFORE GRINDING.

hardly see through them. Very few stores have lenses for sale large enough for the cutter's glasses. Many workmen will buy another pair of glasses and throw the old ones away. One good frame should last a very long time if one makes new lenses. Get a piece of window glass and cut with glass cutter. Run the cutter along a small rule so as to cut the glass straight. Cut the glass square the same width as the frame. Then cut off each corner as seen in the illustration here. Next grind off the squareness on a grindstone by repeatedly turning the glass around as it grinds. A bevel must be ground on the edge so it will fit in the frame. To do this hold in a slanting position on each side of the glass. Try the glass often to see if it will fit. One must grind very slowly when the glass is about the right size for it will take very little to make it too small. It is a good idea to cut and grind two or three pairs at once and have them ready when needed.

MAKING A GLUE MOLD.

Please tell me where to get the recipe for making a "glue mold."—R. Mont. Co., Ill.

You can get this information from either of the following books:

"Plaster Casts and How They Are Made," published by Wm. T. Comstock, New York City.

"Technique of Sculpture," by William Ordway Partridge, published by Ginn & Co., Boston, Mass.

"Modeling and Sculpture," a description of the various methods and processes, by Albert Toft, published by Seeley & Co., 38 Great Russell street, London.

"HARDENING" STONE BY FRENCH METHOD.

The foreigner who sees the workmen in Paris planing down a new stone facade wonders what sort of stone is there used, and if it has any durability. The material, however, which is taken from the quarries under the city itself (abandoned galleries forming the present catacombs) becomes harder by the action of the air. This is, however, not the case with the soft sandstone in Dresden, and other towns on the upper Elbe, which, although easily worked, soon loses its sharp edge.

But recent inventors have worked out methods to improve on Nature's handiwork, by treating the softer building and monumental stones to give them greater strength. De La Roche for instance, of Paris, treats the statues and holdings or decorations with a solution of an alkaline earth—a magnesium or aluminum salt, the acid in which is not very stable, and is readily driven off from its base by a comparatively low temperature. After the piece in question is subjected under pressure in a boiler to sufficient heat to drive off the acid, the latter can be recovered

later. The object in question is hardened by the combination of the salt remaining in the pores—the hydroxide—with the fluoric acid of the stone. The recovered acid can be dissolved with new amounts of lime and alkaline earths, and used again.

Outside of the fact that the process gives articles hardened thereby greater strength than ordinary lime-sandstone in which the proportions are seldom of even the ideal ones, the treated objects contain no excess of sand.

The process is said to be applicable to limestone, also.

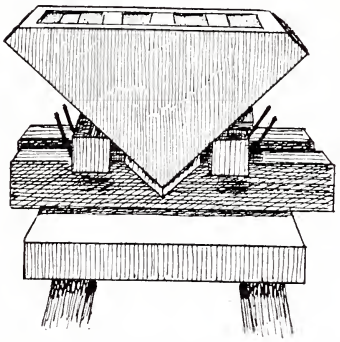
It is immaterial if by the employment of this process slacked lime is dissolved in dilute acetic acid or if sufficient acetic acid is added to a vessel of dilute lime wash, to clear the liquid. The lime must be thoroughly dissolved, so that any impurities may settle to the bottom of the vessel. The articles are then placed in the solution and left there until they are perfectly saturated, before being placed in the boiler. The best temperature for the latter is 115-120 C-230-248 F., which thoroughly decomposes the acid.

HOLDER FOR TOOLS.

Workmen having trouble with pneumatic tools getting too hot or too cold should have a piece of leather neatly sewed around the tool leaving a hole in it for the exhaust. Not only will it prevent burning the hands, but is far more comfortable to handle of a cold morning. Leather could have holes punched in and laced up with a shoe string or sewed as preferred.

HOLDING BEVEL FACED MARKERS.

Bevel faced markers are difficult to hold securely when they are bankered to be lettered. To place the corner on the bench so that the bevel face will be level and put blocks on each side is not enough. It is rarely held secure enough and to have a piece of stone continually moving makes it hard to letter. It also keeps a man pounding at the blocks with his hammer every few minutes because they work loose. If one will saw a pair of blocks of the same size, bevel shape, at the center, like the illustration here, and use them in this manner, a stone can be held solid. Blocks so sawed will not fit all corners of this description. It is well to saw the opening large enough so that rock-face work will go into the corner. When a stone that has a smooth corner fits into the block it is often loose; a small wedge will tighten it. To hold any stone absolutely secure one can drive a tool into the bottom block slanting against the top one



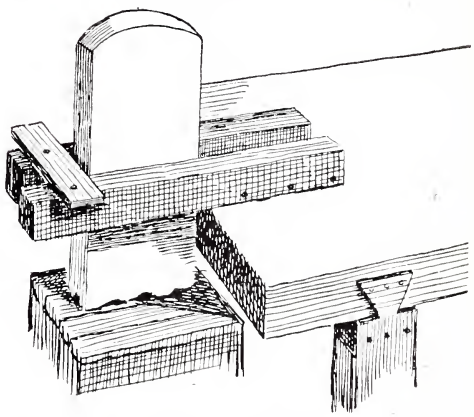
BLOCKS CUT TO HOLD BEVEL FACED MARKERS.

These blocks are very handy, as they also save much time when bankering a job and they can be used lengthwise of a banker and the stone placed in the handiest position for a letter cutter because he does not have to reach over the end of the bench when lettering.

FOREMAN.

HOLDING SMALL STONES TO BE CUT.

It is very difficult to hold a small sized stone and cut it at the same time, because it is not solid and the heavy blows from mallet or hammer send it over with every blow. A simple way to hold such pieces is shown in the illustration. Set it on a box or blocks against the end of a banker, then nail a small block to the banker on each side of the stone. Four-inch blocks are most suitable for the purpose, and they are nailed to the banker

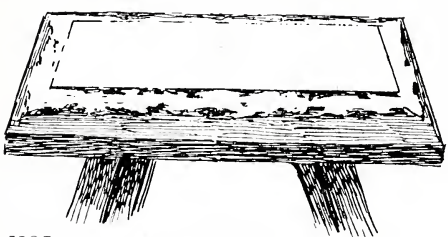


HOLDING SMALL STONES FOR CUTTING.

from the sides, as nails are not generally long enough to go through such blocks. At the outside of the stone there should always be nailed a small board to the blocks. This board must be pushed tightly against the stone before nailing. One can save a great deal of time if he has very many of such small stones to cut by sawing the end of the bench a general size, and wedging stones in.

HOLDING AND HANDLING THIN MARBLE SLAB.

Many times in a work shop one is called upon to cut some delicate work in marble of small thicknesses, and a great many times as thin as ⅞ of an inch. It is sometimes a problem how to hold this thin slab secure enough to prevent breaking. You can not hold it securely in a vise for there is danger when clamping the jaws together of crushing the marble. An easy and always reliable proceeding is to hold the marble fast with plaster of Paris. Use



HOLDING MARBLE SLAB WITH PLASTER.

a slab of stone, any dimension that is larger than the one to be cut, that has an even surface; wet this stone thoroughly. Then mix the plaster in a large enough quantity to insure plenty to gather on all sides at least 1½ inches from the marble. Do not mix by first putting what you think a sufficient quantity of plaster in a bucket, then pour water on to make thin; also continue to stir as you mix. This is altogether the wong way. It makes the plaster seem dead. The right way is vice versa. Put a sufficient quantity of water in the bucket first, then sprinkle the plaster over the surface of the water until it almost ceases to absorb. Then carry to the stone and stir, not much, but enough to have it well mixed. Use a wide wooden paddle if a small quantity is being used and if a large stone is to be made fast dump the contents of the bucket on the slab, then immediately put the marble on the plaster and with both hands shift forward and backward until it appears down; scrape the plaster around the edge up to the top of the marble and let it bevel off gradually. A few small pieces of stone can be put at different places in the plaster to insure a more secure fastening of the marble. When this process has been finished it is only a short time until one can commence cutting. By this process you can cut a cross through the thickness of the marble without changing its position. Letters can be cut, also interlaced work in relief, or sunk mouldings on the edges, etc. To lift the piece after being cut and to prevent it being broken use a wooden mallet and pound on all sides of the marble on the stone it is secured to; this is sometimes sufficient to loosen it, if not use a small thin marble tool and pound very lightly at a number of places on all sides. It will then immediately unfasten.

* * *

Workmen are often called upon to cut or polish a large thin slab of marble used for a large counter, or table, and it is ofttimes a problem how to carry the slab without breaking it, to a position that will be handy to work on. At all times the slab should be carried with the edge up, and not by one man at each end holding the flat side up, for if carried in this manner it generally results in a broken slab. When the slab is small and only requires the strength of two men to carry it, one man should be at each end, holding it against the body, with the edges up. But when a slab of considerable weight has to be carried, short ropes must be used by putting them under the bottom edge of the stone. It will then require one man to hold and lift at each end of the rope. While lifting, the body must be pressed hard against the stone. This keeps the body in balance and also helps each one to walk much easier than if he walked erect. The larger the stone, the more ropes and men will be required to carry it.

GILDING AND BLACKENING LETTERS.

Regarding the gilding of letters on monuments, I should like to describe a very simple outfit for this kind of work that I am furnishing, known as "Amber Gilding Oil." We all know that the lettering is hard to read because there is no contrast, no matter how sharp or deep the letters are cut. With my method, the gilding can be guaranteed from one to

fifteen years' service, if applied in strict accordance with my directions. I cook and mix the oil mentioned in my directions myself and sell it in pint and quart bottles. The other material required, such as white lead, chrome yellow and gold leaf, can be bought in every paint store. Following is my method of applying amber gilding oil:

"Dust the letters until they are clean and apply the first coat of white lead colored the same color as the stone. After twelve to twenty-four hours, apply the second coat with the same color, using a trifle more of amber oil, so as to thin it, more than the first coat. After both coats are absolutely dry, first take chrome yellow and mix it well with the amber oil and apply the third coat. After this is applied, be very careful that the last coat does not get too dry. The best way of ascertaining this is to touch it with the finger tips and if the coloring is sticky, without coming off of the stone, then is the proper time to start gilding. Take a soft brush and apply the gold leaf in pieces the size of the letters and press it lightly with the brush. After all of the letters are covered with gold leaf, brush them out very lightly and after the gold leaf has been applied for twenty-four hours, take a soft camel's hair brush and go over the letters, polishing them until they shine. To remove the paint and gold leaf that has been run over the side of the letters and out on polished surface of the stone, take a double piece of cloth, large enough to cover the entire surface of the inscription, wet same with clean water and apply it flat without any folds over same. After two or three hours, the inscription will be ready for cleaning. Take a piece of zinc or copper four to six inches square, put a sharp edge on same and scrape the paint off. After this, let the letters dry and brush them again with the camel's hair brush, after which your inscription will be perfect.

ARTHUR BERLINER.

* * *

"Will you kindly tell us how V-sunk letters are gold leafed?

Paint the V-sunk letters a coat of yellow paint as close in color as possible to the gold. This in the first place overcomes little spots that might be missed with the gold, but the main object of this paint is to make the gilding stand from five to ten times as long as without this paint. Years ago I had several inscriptions gilded by an expert gilder; he did not use this paint and the entire gold was out inside of two years. Then I began doing it my way, and gilding I made twelve years ago is perfectly good today. I use Masury's chrome yellow, senna shade, obtainable in tubes at any paint store. Thin it with some old linseed oil or turpentine, but old oil is preferable. I have extra oil standing for twelve years for that purpose. When paint is dry, apply a coat of gold size (I use Masury's Japan gold size) and in about 45 minutes in dry weather, longer in wet, it is time to put the gold in. Use Hasting's XX gold leaf, obtainable at a good paint house. An expert gilder will, of course, cut his gold leafs into small pieces and apply just where needed and save gold as against my method, but I had rather use 25 cents' worth of gold more and save two hours' time. Open the leaf; cut it in half and put it on; put on enough all over, then use a fine soft camel's hair brush to press the gold down into the letters. Then I cover the face of stone with a wet sheet of cloth and after three hours scrape off all paint that is over. The gilding looks a little rough first, but wind and weather make it perfectly smooth in a few days.

WILLIAM STAMPA.

* * *

Before applying gold leaf the surface of the letters must be cut very smooth and all miters and corners must be sharp and even. To prepare the surface for the gold leaf you must first heat well the white of an egg and spread over, using a brush. By doing this the size, which is next used, will not stain the stone. After the egg is dry, put gold leaf size over this with a brush and be careful it is spread evenly. This size must dry until it is just the least bit sticky. It often takes eight to ten hours to be in the proper condition. The gold leaf must be cut the size required for the different bars and picked up and placed in the letters with a camel's hair brush. When one letter has been filled use a clean piece of cotton and press all over the gold leaf, getting it down even. At the corners use a chisel with some cotton at the end of the blade. Do not clean the edges of the letters until the size is thoroughly dry. Then clean off with a sharp lead chisel. Never disturb the size with a brush or your fingers, because it will prevent it from holding the gold leaf. FOREMAN.

A good enamel for V-sunk letters is Vitralite.

Before using enamel one must prime the letters with zinc white mixed with turpentine and let it thoroughly dry. Then brush the enamel over the prime very evenly. When applying the enamel do not let it run over the surface of the stone, for the reason that there is crude oil in the mixture, which would stain the stone. The edges of the letters must be cut very sharp to insure a clean job.

GILDING MARBLE.

To gild letters clean out letters carefully with a small brush and apply a coat of either white or orange shellac. When the shellac is dry put on one or more coats of gold enamel.

To Gold Leaf Letters.—Shellac is first applied and then a coat of exterior spar varnish for a sizing. It is well to add a touch of yellow ocher to the varnish as that makes a better foundation for the gold. The gold leaf should be put on before the varnish is thoroughly dry—otherwise it will not stick to the marble. Go over a few letters with the varnish—by that time the first one will be ready for the gold. Cut pages of gold leaf book into strips of the required width, having first moistened the back of the pages with turpentine to keep the leaf in place, and lay them, paper side up, over the letters. Then use small brush or sponge rubber—some workmen use simply the tip of the finger—to press the gold down into place.

To Blacken Letters.—Apply shellac as in the case of gilding, then use one coat of black made by mixing lamp black and exterior spar varnish. In mixing this color, fill little cup with varnish and place small quantity of black on a palette or piece of glass. Dip brush in varnish and work in black as it is needed. If all of it is mixed at one time, it will be likely to leave the letters streaked and blotchy. To remove surplus shellac, black or gilt, use the soft side of cuttle bone.

—From Vermont Marble Co.

HINT ON GILDING STONE WORK.

Apply a coat of size to the letters or places to be gilded, then mix the size with a little powdered chalk or whiting. Let each coat dry hard and rub down with fine glass paper before the next is applied. This will give the filling necessary. Apply gold size thinly and evenly, and when still sticky put on the gold leaf, using oil gold size for laying the leaf.

DRESSING GRINDSTONES.

Grindstones should be dressed every day so as to keep a good, smooth surface, for they will always cut faster and one can grind a chisel straight, which is required especially when lettering granite. One can not gain much time when lettering granite with round chisels. A handy way to dress a grindstone is to use a small gas pipe held against the back side of the stone firmly while it is turning, cutting with this pipe until the stones ceases to have any bumps and hits the pipe all the way around while held in one position.

IVY LEAVES—HOW TO CUT.

Considering how common the ivy leaf is, and how many of them there are cut, it is astonishing how few of them are cut right, even in some of the best shops.

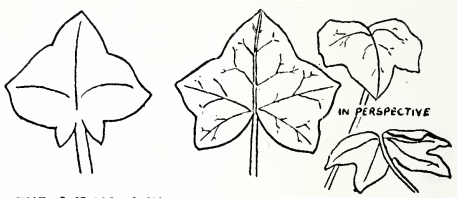


FIG. 1.—A COMMON MISTAKE IN CUTTING IVY LEAVES.

There is no excuse for cutting these leaves in the same old improper way. There are plenty of leaves in every cemetery; get one, and keep it at the shop. When you draw one on the stone look at the natural leaf. Do not depend on your knowledge of drawing these leaves for the chances are you don't know half as much about it as you think you do; get the leaf and study it carefully and you will find there are some things you have overlooked in what ought to be a very simple job. The illustration in Figure 1 shows very clearly the right and wrong way.

THE LARGEST STONE EVER QUARRIED.

Harry Hems, a well-informed English stone man, who once visited this country, writes to the Stone Trades' Journal to deny the report that the block of Maine granite quarried for one of the columns of the Cathedral of St. John The Divine in New York, was the largest ever quarried. Mr. Hems says: "The stone was

64 ft. in length, 8½ ft. thick, and 7 ft. wide, its weight being 310 tons. It may be interesting to add this stone never reached its intended destination. As a matter of fact, it was never moved out of the quarry in which it is said to have been raised. The eight admittedly large granite columns there (but by no means the largest ever quarried) are placed considerably east of this tower. None of them are monoliths, but each is in two stones, together 54 feet in height and 6 feet in diameter. The joint, in all of them, occurs 36 feet above the floor line. These columns (taking the two stones together) weigh 155 tons apiece. The largest stone ever quarried is generally accepted to be still lying in the quarry where it was detached in prehistoric times, but never shifted. It may be seen in some ancient workings a few miles from Damascus. It measures 70 ft. by 14 ft. square, which means 14,228 feet cube. In the Great Temple of the Sun, at Baalbec, in the same locality, stands a column in position, which is 66 feet high, and this, probably, may justly claim to be the largest in the world.

SIGNIFICANCE OF LAUREL WREATH.

Will you kindly let me know something of the true significance of the laurel wreath and whether having them open at the top, with the streamers below, or open at the bottom, with the streamers at the top, changes the significance; also, which is the most popular or correct form? I am designing a shield for some new stationery and wish to use the wreath in this connection.—M. A. H., Pa.

The laurel wreath so often seen on memorial stones and decorative carving has a significance that many are not familiar with. The plant itself is one of several varieties, known commonly as "Victor's Laurel," but called by the early Greek "Daphne," though many Grecian historians call it the bay tree.

The laurel was the sign or emblem of Apollo, God of Light. Some authorities say it is because he was born in a laurel grove, thus rendering the laurel sacred to the gods, but more often it is credited to his love for Daphne, the nymph who loved the forest. Apollo, on seeing her, loved her and pursued her. When about to be overtaken, she threw herself into the river, from whose banks at once sprang forth a laurel tree. Apollo, in penitence over his disastrous pursuit, called the shrub "Daphne" and took it for his symbol, declaring it sacred.

Berry bearing twigs were woven into wreaths and wound around foreheads of victorious heroes, thus causing it to be used as a symbol of triumph. Apollo was the god of poets, and poets also received the crown of laurel. Later in Greece and Rome the degree of Doctor was given with the laurel crown, from which comes our term "laureation" and title of "poet laureate." The laurel wreath was also used as a sign of truce, as was the olive branch. Also when letters were sent to the rulers that told of great victories or heroic deeds the outside was garnished with the laurel wreath used as a seal. The laurel wreath was also considered a protection, being set before Greek doors and carved thereon. The Emperor Tiberius always wore one during electrical storms, as it was believed it could not be struck by lightning. It was forbidden to be put to any profane use. Apollo, being purified after his slaying of the great dragon of Krisa, who pursued his mother, Leto, before his birth, became the god of purification and atonement. The laurel wreath was used on all his sanctuaries as a sign of protection therein, and purification and atonement to all penitents who came to him asking help. The Roman legends are similar. All agree in calling it a symbol of triumph or victory, an emblem of purification and atonement and a crown of highest honor to poets or victors on whom it might be conferred. We can find no reference in authority to the matter of the streamers. This would be entirely a matter of choice with a view to most artistic effect.

LIGHTING DEVICE FOR CUTTERS.

The accompanying sketch, from F. D. Black of Grand Rapids, Mich., shows how their workmen use electric lights to work by. This device was introduced by one of their men, and is such a success that they believe it will be appreciated by all who are forced to use lights these short days. As a rule, in granite and marble lettering the question of how to utilize the light of a lamp, when necessary to use one, has been a perplexing problem. The workman must necessarily move the light into many different positions in order to be able to see to do his work; and even then it proves very unsatisfactory to both employer and employe, because of the inevitable shadow which is cast upon the stone.

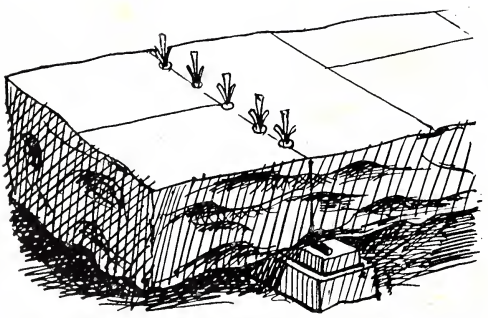
One has never been able to see through his own shadow, so he must move his light into a different position each time he turns around. Where electricity is used for lighting purposes, this condition can be remedied very nicely and with great satisfaction to the one who is using the

PORTABLE ELECTRIC LIGHT FOR STONE CUTTERS.

light, by making use of the lamp as shown in the accompanying illustration. In that way a light, equal to the best daylight, can be obtained and there are no shadows to contend with. The wire guard protects the lamp from being broken and affords a convenient way of fastening the lamp to the head by means of the strap, as shown. They believe that this arrangement furnishes the best light with the least bother.

MANUFACTURING MARKERS.

Retail manufacturers that handle markers in large quantities will by buying large slabs of sawed granite of different sizes and breaking them up save time and labor. These slabs can be bought at the quarries of different length, width and thickness and different size markers and even small dies can be broken from a slab as one needs for an order or for stock. They have the advantage of being sawed with the grain, therefore the top for a marker or face of a die to be lettered will be on the head grain of the stone insuring a darker color and more even grain. It will take a better polish and will also insure when cutting the letters that they will be more solid and much easier to cut. Then, too, there is not so much danger of breaking off a corner or a bar of raised letters. It is a good policy to always have one or more of these slabs rubbed or polished immediately when received from the quarries. The top surface has saw marks on it and by putting the large slab into the rubbing bed under the polishing machine, grinding the surface of the slab down to what is called an ironed surface or polishing it is a very much quicker and better way than when putting markers into the bed to polish separate after being cut. To break a slab with a thickness of from 8 to 12 in. one can determine by measurement how many and what sizes to be gotten from it, and can be generally measured so as to have very little waste. To properly break a slab the first thing is to drill holes at a distance of about 7 in. apart. Then raise one end with a jack or by crow bar if possible; put blocks under, then a small round piece of iron on each end on top of the blocks exactly under the line. Then inserting the plugs and feathers in the different holes hammer them down one at a time until they are tight. It is now advisable to use a cutting chisel and hammer a line between those holes tunning the granite; also at the sides down to the bottom of stone. Then hammer each plug at a time in rotation until the slab has been broken. Repeat the process on the first broken off pieces to get your exact sizes of smaller ones. Generally this break is so even that it requires very little cutting. The bottom being rough, is the only labor of any length required to get a marker or small die in good condition. Should more than one side be required polished on some markers, put several in the bed at once and polish all together. It is a waste of time to polish a small piece alone.



BREAKING SLAB INTO MARKER STOCK.

MARKING STONE FOR SHIPMENT.

The attention of the Bureau of Chemistry of the Department of Agriculture has been directed to the fact that shipments of granite frequently go astray because the protective crates are broken off, leaving the stones without delivery marks.

It is the practice to avoid stenciling, or other ways of attaching identification

marks to the stone itself, on account of the tendency of the coloring matter to penetrate into the pores of the stone, making it necessary, in some cases, to remove the surface to a depth of from one-eighth to one-quarter of an inch. Experiments were carried out by H. P. Holman in the Bureau, with a view to finding some marking material which could be applied to the stone itself and which could be easily removed from the stone after delivery. The cheapest and simplest material which was found to give satisfactory results is an ordinary stencil paste ink designed for use on wood with water as a vehicle. Such pastes usually consists of lamp-black as a coloring material, clay or sulphate of lime as a filler, and gum or other soluble binding material. It is possible that all the stencil pastes sold for use with water are not suitable for this purpose. Some might contain ingredients which would make them objectionable. In applying such stencil pastes as little water as possible should be used on the brush. Stencil inks or paints consisting of lamp-black and a volatile oil, such as gasoline, turpentine, etc., penetrate into the pores of the stone. Stencil paste applied with or thinned with water does not penetrate the stone, and marks made with it are not entirely removed by running water either from rough or polished surfaces, unless rubbed at the same time, showing that on rough surfaces enough of the material will withstand the action of rains and ordinary wear to remain legible for a long time. The marks can be entirely removed by scrubbing with water and a stiff brush, and from very rough surfaces by using, in addition, a little fine sand.

A better but more expensive stenciling paint can be made by triturating unvulcanized rubber with sufficient carbon tetrachloride to give a solution having about the consistency of paint and incorporating with this solution dry lamp-black.

This material can be applied with a lettering or stencil brush, and dries rapidly, leaving a very black mark. The brush, when not in use, should be kept immersed either in the paint itself or in carbon tetrachloride in a closed container. As this vehicle is very volatile, the paint must not be exposed to the air except when in use. It is not inflammable, but has anaesthetic action similar to chloroform and must not be inhaled in large quantities. Marks made with this paint withstand the action of water and ordinary wear, and can be removed quite easily by scrubbing with water and a stiff brush, using a little fine sand in removing the paint from the depressions on rough surfaces.

MEANING OF MONUMENTAL SYMBOLS.

Anchor—Hope.

Chrisma (X. P.) and I. H. S.—Both Greek contractions of the word "Jesus."

Circle—Eternity, God, Heaven and Trinity.

Cross—Death.

Dove—The Holy Ghost.

Festoon of Flowers—Memory.

Fruit and Vine—The Personality of Christ.

Horse—The long journey of death.

Ivy—Memory or Friendship.

Lamb—Modesty, Innocence, Meekness.

Laurel—Glory.

Lilies—The Resurrection—also Purity.

Oak—Strength.

Olive Branch—Peace.

Palm—Victory.

Passion Vine—The Anguish of the Crucifixion.

Poppy—Sleep, or Death.

Rope—Eternity.

Serpent—Death.

Shells—The Resurrection, or a Pilgrimage.

Star—Birth, or Life.

Sun Disk—Divine Power.

Sword—Occupation.

Triangle—The Supreme Being.

Upright Torch—Eternal Life.

Inverted Torch—Death.

Wreath—Memory.

—*Vermont Marble Co.*

MENDING LETTERS.

To take out marks or ugly bumps on granite, use a blow-torch. Heat to a blue flame and hold 3 inches away from the disfigurement; with a chisel in the other hand, help loosen the spall. Keep away from the edge or off goes the edge. Red shellac is best for mending polished broken letters. Heat a tool red hot, hold over the letter which has been broken and the broken portion. When hot put on the shellac, squeeze them together, and place a weight on same to make them even.

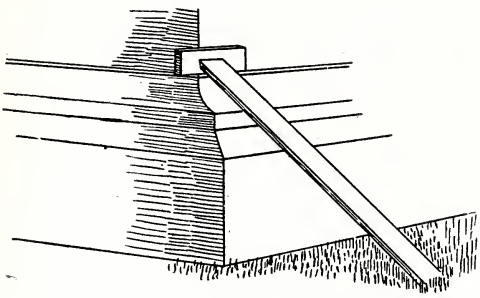
Meyers' German cement is good to stick on hammered letters; weight them and let set for ten hours. When you are sticking them throw some granite dust on—it will help to give the cement the right color.

To take out most any kind of stain in

granite use gasoline and plaster of Paris; mix well, put a large batch over the stain; when this is dry and washed off, if the stain has not disappeared, repeat the process.

MENDING BROKEN CORNERS.

Should a finished cap, die or base through accident at the quarry or on the railroad when unboxed have a broken corner, at once find the corner piece. Generally it will be in the box. If the main piece can not be cut down to another bed, obliterating the disfigurement, you will have to stick the corner on, but do not do so until it is set in the cemetery, for it might be broken off again when setting. For polished work get some red shellac, liquid form, which is better and handier



HOLDING A MENDED CORNER IN PLACE.

to use than the shellac leaf. Put the broken corner into its proper place after putting on an even coating of shellac. See that it fits snugly and that the joint is even all around. Use a blow torch to heat the broken piece, also the body of the stone around it. Be careful that you do not get it too hot or you will crack off another piece instead of putting one on. Just heat hot enough to melt the shellac; also be careful do not get the flame of the blow torch too near, for it will turn the color of the stone yellow. When hot press hard on the broken corner and clamp, holding it tight until the stone is cool. If you have no clamp use two boards—a small board, by putting it against the corner, also a long board, one end in the ground, the other against the small board, pressing down hard until tight, as illustrated. Do this as soon as you take the blow torch away. For hammered work use Meyers' German cement, mixed with some granite dust, which must be lighter than the color of the stone, for this preparation sets a little darker than it is when mixed. Use a clamp or board, as shown in the illustration. Should a corner be lost one can be made. With this cement, granite dust also add a little whitening. Mix it considerably lighter than the stone. Put this mixture into the vacant place. Use two boards, one on each side of corner, putting props against them, and let set at least two days. Then with a sharp chisel clean off evenly. Also indent marks like the 12 or 12-cut bush hammer has left on the stone.

A polished corner can also be made by using the same mixture as for hammered work, adding a little lampblack to get the general color of the polished surface. Put on a clamp or board, as in former directions, and when set the stone must be evenly matched, and it can be done by using oil paint—blue, black or white. If for Barre or granites of similar color, and for red and blue-black spots like Missouri, etc., red paint will have to be included in your palette. Mix the colors to suit each individual spot of the stone. Put the spots on the cement the same in character as the spots near where you are going to work. Some will be nearly round, some nearly square, some long, etc. Make the spots to match accordingly. Take plenty of time to do this, and get your work correct. Let the paint dry at least three or four days. Then give several coats of varnish, which will give the appearance of a polish. Let one coat dry before applying another. By being careful and using patience this process can be skillfully done.

MENDING AND WORKING ONYX.

To mend broken onyx one must at the time of breakage be careful that he saves all the pieces and that the edges do not get shattered or chips be broken off. Place the broken parts on some level surface such as a slab of marble, which is the best, or a bench. Proceed to heat the onyx until it is too hot to put a finger on; then put shellac in leaf or liquid form on one part, covering all of the joint. Immediately put the two pieces together and press hard until the shellac has squeezed so that the joint is even or close together. If in a condition to clamp, do so. If not, put a heavy weight on and let remain until the onyx gets cold. Often when sticking onyx there will be places near the edge that have crumbled. This can be mended by using wax in the same way as one uses shellac, by heating the stone some and then heating the wax over the hole and letting it run into it. When cold, cut the lump away carefully with a knife, but

not down to the surface, for if you do you might pull the wax from the hole. After using a knife, rub with pumice stone, then with a hone, and then polish. Shellac can be bought at any drug store; most any color wax can be bought from a good marble supply company. If not, use express company wax, which will be suitable for the purpose. The best way to heat the joints is with a blowpipe. If you have none, heat a large piece of steel and put down close to the onyx with two small tools under it, so as to keep it off the surface. *J. W. W.*

To cope thin slabs of marble with a pneumatic tool, mark your line and with plain chisel held flat on the line run it from one edge to the other on one side several times and press hard; it will break straight. Have the slab flat on the bench, nothing under it. When you cut onyx saw as much as you can and then cut slowly and with very thin, sharp tools.

MODELING CLAY.

We reprint as follows brief instructions for modeling clay: "Modeling clay may be made of common clay by first drying thoroughly, then picking out all small stones and lumps of dirt, pound with a hammer, then roll with an iron roller on a flat piece of granite or marble until very fine. Sift with a common flour sifter and add water, kneading it like dough with your hands until thoroughly soft and moist, but not wet enough so as to stick to your fingers. To have clay always ready for use, keep in a jar, covering the top with wet cloths. If you do not keep it this way it will harden, all the water will evaporate and your clay will require kneading again, which takes time. To avoid this labor and unpleasantness after sifting use vaseline instead of water, taking a double handful each time with vaseline, knead until it is soft. This process will insure 'always ready' clay."

* * *

It is better to buy modeling clay in powder form, and the way I mix mine is to take a tub about one-third full of water and shake into it the powdered clay until the clay has soaked up all the water. If the clay should be too wet to use, either work in more powdered clay until proper consistency for modeling, or else spread out on some clean place in a layer three or four inches in thickness for a day or so until it is in readiness for use. When using the clay, in order to keep it in good shape it should be sprinkled from time to time when it is uncovered, and when not being worked upon it should be covered with a damp cloth and carefully wrapped up with oilcloth, with the oily surface of the cloth next to the figure.

FREDERICK C. HIBBARD.

MODELS FOR CARVING LEAVES.

A quick and effective way to make plaster casts of leaves, such as ivy, oak, etc., take a branch or section of vine having the leaves that you want, pull the leaves off, make a model of the stem and main vine of clay as near to nature as you can, then place the leaves in their natural order, filling up under each leaf with clay to their natural shape. Melt paraffine wax and pour over whole model; when the wax sets you can wash out the clay and pull out the leaves. Mix plaster paris and pour in mold; when this sets put in oven and melt wax off. With a little practice you can make all your own models of this class.

JOHN HARWOOD.

PENCIL LINES ON GRANITE.

The best preparation to use on granite to make lead pencil lines show up plainly and lines which will not rub off easily, is gum-arabic in lump form diluted in water, enough so it will be a little sticky, and whitening mixed with plaster of Paris. Mucilage is handier to use, as it is already diluted. Keep your mixture of mucilage and water in a bottle, make a hole in the center of the cork so that you can shake out the required amount evenly; the whitening and plaster of Paris in a can with holes in the lid. Shake a little of this powder on the granite, make a hole with your finger in the pile, pour this solution of gum-arabic and water. It will not run all over the stone if you follow this method; use the flat of your hand and rub over the surface of your stone several times, lastly very easy so as to leave the preparation nice and smooth, blow with the air hose to dry it. If in a shop with no machinery, fan it with a newspaper to dry it.

* * *

Pencil lines can not be seen on polished granite without some preparation on the surface. To prepare a die or base that is to be jointed, or the top to be cut, for pencil lines, use a lump of plaster of Paris and rub hard over the polished surface

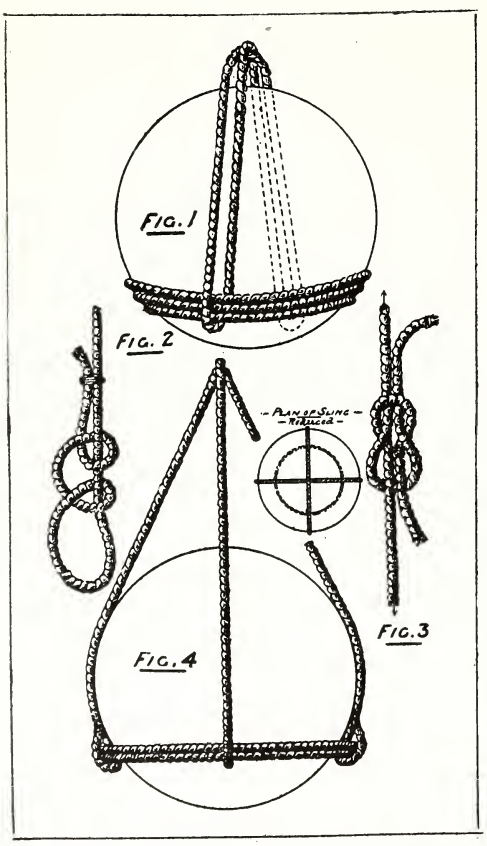
where the lines are to be drawn. The plaster will stick sufficiently so lines can be seen. In large shops which manufacture, these lumps are plentiful at the polishing beds; in the smaller shops, buy 5 cents' worth of plaster of Paris, mix with water and mold into a usable shape and let dry. It is then ready for use.

LIFTING POLISHED GRANITE BALLS.

Having a polished granite ball to raise 7 feet from the ground on to its resting place, surmounting a monument, a correspondent inquired if it could be safely done by placing about it a clamp arrangement similar to that used on all polished dies.

The diagrams, here given, illustrate quite clearly the simple means used to lift even the heaviest of polished granite balls.

Figure 1 shows the rope sling, as used by William Dunbar, of the J. H. Anderson Granite Co., of Chicago, by which a ball, 4 feet in diameter, was a short time since successfully and safely lifted to its seat. A 1½-inch rope is wound around the under side of the ball and tied as firmly as possible, making a good seat for the ball. The rope is then carried twice over the ball, which forms the sling into which the hook is caught. This has proved entirely satisfactory, and there is no danger of slipping, provided the ropes are reasonably tight.



METHOD OF LIFTING A POLISHED BALL.

Figure 4 is the four-rope basket sling, used by George Archer & Son, of Chicago. Properly tied, it is impossible for the ball to slip out. Make a coil of rope about a third of the way up the ball on the under side, and then lash 4 cross ropes over the top of the ball, giving plenty of drift. As the strain of lifting is felt, the ropes will bind themselves and the ball will be balanced as it leaves the ground, and, as Mr. Archer says, nothing can happen to the sphere afterwards.

Figures 2 and 3 show knots, loosely tied, however, to give the construction. Figure 2 is a slip-knot, made of two half hitches, as the sailors say, and which can be utilized where loose ropes are used to make the basket or sling, and which can be tied at their proper places on the lower coil-figures 1 and 4. In figure 1 all the knots used should be square knots, like Figure 3, if two ropes are used for coil and sling.

In lifting heavy weights the utmost care must be exercised in tying the knots in the ropes to prevent slipping; the square knot, when properly tied, can never slip, but it is in making the square knot that the novice often makes what the sailors ridicule as the "granny" knot, and which said novice seems always more prone to construct than the proper and efficient one.

An inch and a half rope should be equal to any sized ball so far turned, but it is always good practice to be on the safe side. An adept sea officer suggests that where a firm has many such balls to lift, it might pay to have two or four sling ropes kept in stock, having loops spliced on one end, and these could be slipped over the coil rope before tying it, so that lifting a ball would be a short job. It is also suggested: Never hook onto a sling when its ropes lie side by side in the hook; the hook should always be placed diagonally, then the ropes cross on the hook. This must be provided for in the arrangement of the ropes for the slings, and which Figures 1 and 4 plainly show.

It is pretty evident that the rope sling, where rope is to be had, far excels any bolted clamp device. It is far less ex-

pensive, more certain and effective, and where proper care is exercised, is practically without danger and consequent loss.

POLISHING GREEN AND BLACK MARBLE.

Green putty powder should be used to polish all green and black marble, but it requires a great deal of patience and much physical strength. This putty can be bought at any marble and granite supply house. It has to be prepared, for it will not polish the marble by using it dry out of the can. Put this powder in water and let soak until all has dissolved and has become a thick paste; this requires sometimes a day, but it should always soak at least 12 hours. With a wooden paddle or spoon put a small quantity on the stone, using a good piece of woolen cloth for a mop, and rub the surface hard. Add water to this every few minutes; also add more putty as it is used up. Continue rubbing hard all over the surface evenly until a luster begins to show, then increase the spread of rubbing, but do not use so much water, and, as the shine improves, increase your speed. Get the surface of the stone warm by constant fast rubbing. This will help the stone to shine. When a good polish has been obtained, wash off thoroughly with soap and water, and when cleaned off nearly dry use a solution of oxalic acid and plenty of water, and a clean cotton rag. Rub all over very rapidly, but only for a short time. Immediately wash off again with soap and water, for, if you do not, the acid will burn the surface and the stone will show little pimples all over it. The acid is used to make the polish clear, and must be used fast and gotten off quickly. To help this process shave off a small piece of a common bar of washing soap and put on the rag with the putty powder. At all times when rubbing stop frequently and scrape the loose putty off the sides of the stone. If you do not, they may be burnt.

POLISH FOR BLACK MARBLE.

Dissolve one ounce of gum elemi in four ounces of denatured alcohol. Strain the solution and add it to a mixture of eight ounces of linseed oil and ten ounces spirits of turpentine. Stir well and add one ounce acetic acid and seven ounces soft water. Shake well before using.

KEEPING THE POLISH CLEAN.

A great deal of acid is wasted when cleaning granite that has just come from the polishing bed because many polishers do not properly prepare the side that has been previously polished from the stain of shot and steel that is being used on the next side. Shot and steel stain running over the polished surface cause it to look dirty. Then it requires an acid to get this off, so that the polish will look clear. To prevent this, mix plaster of Paris and with a large broom wipe the plaster over the side that has just been polished. When this sets, which will not take long, the stain and slime from the grinding of another side will run over the plaster instead of over the polished surface. Clean water mixed with a little acid, and a sharp, wide chisel will take off most of the plaster. The remainder is taken off with a stiff scrubbing brush, using soap and water. POLISHER.

MOUNTING PORCELAIN PHOTOGRAPHS ON MONUMENTS.

To properly secure a porcelain photograph to a piece of marble or granite, cut a hole one-sixteenth of an inch larger than the photograph all around, making the bottom, which should be one-fourth of an inch deep, very rough with holes left in this bottom, but the outside must be cut smooth and sharp. Use plenty of Meyers' German cement—enough so when the photograph fits in the hole the cement will squeeze up all around the edge. Wipe this edge off carefully, put a small weight on top, and let set 24 hours. Do not touch while setting.

SCULPTOR'S PUTTY.

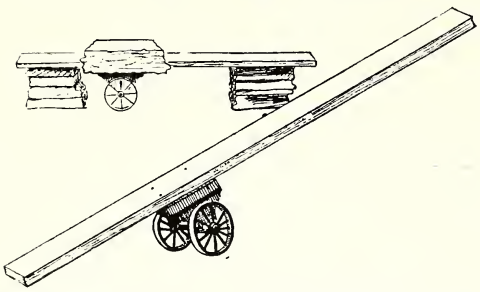
Stir into three parts by weight of melted white wax (not too hot), one part of wheat flour and two parts of Kaolin or powdered soapstone. Knead well before cooling. Color to suit.

ROLLER BANKERS.

"Where can we get roller bankers on the order of a truck with the handle that can be put out of the way when we are working on same?

We do not know of any one selling them, as these bankers on wheels are homemade. The material is a pair of cultivator wheels, a long 2-inch board of hardwood, and some blocks for the bed of the board. The value of these bankers is,

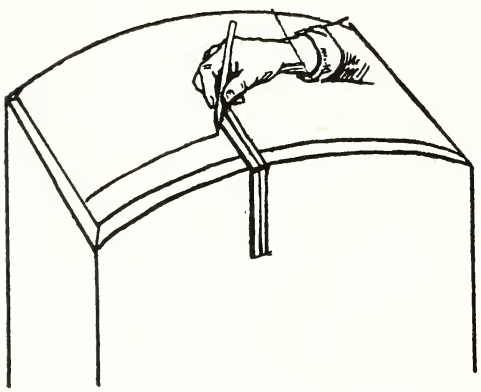
one can roll a stone on either end when it is pushed to the floor. The short end is generally used, as it is much easier to load and roll to the center than the long end. When the stone is rolled on the board to a place over the wheels it is on



a balance. One man holds the long end and guides while another one pushes from the short end to the place of destination. One can work a stone on this banker by placing blocks under each end like the illustration here; but it is very easy to roll this truck to a stationary banker and place one end of the truck on it, then roll the stone off the truck onto the stationary banker. Using this truck saves a great deal of time in bankering jobs. If it is in the way inside, keep it outside, or arrange so that the long board can be movable, taking it off the wheels and standing it up against the wall.

DRAWING ON ROUND TOP DIES.

One cannot use a common square and lettering block with much success when laying off lettering on round-top dies and markers; nor can one use a straight-edge to draw the top and bottom of the letter lines. These lines are drawn correctly by holding a chisel under a ruler, letting the ruler extend over the top to the proper place to draw the line. One hand guides the chisel and rule, running it along the edge, while the other holds a pencil against



HOW TO HOLD RULE TO DRAW ON SURFACE HAVING MITRED EDGE.

the end of the rule and marks a line like Figure 1. After these lines are drawn, many workmen try to depend on their eyes to judge perpendicular lines drawn free hand. This is a very unsatisfactory process on account of the top being round, which makes it misleading. The consequence generally is that many mistakes are made with repeated corrections. For correctness and quickness a square can be made in a short time just for this purpose, one that will last several years. Figure 2 shows one in use. It can be made of green hickory, of sheet iron (with the

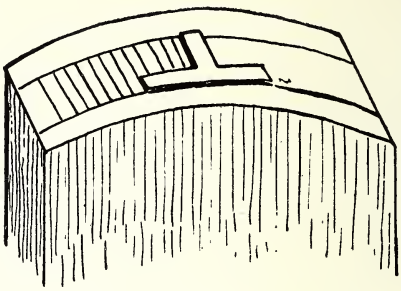


FIG. 2.—SQUARE FOR DRAWING ON ROUND SURFACE.

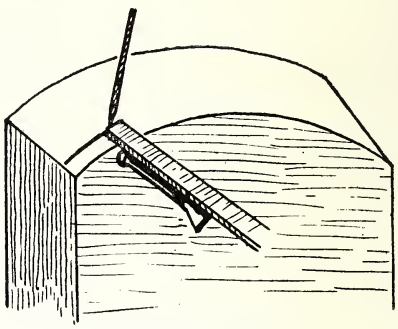


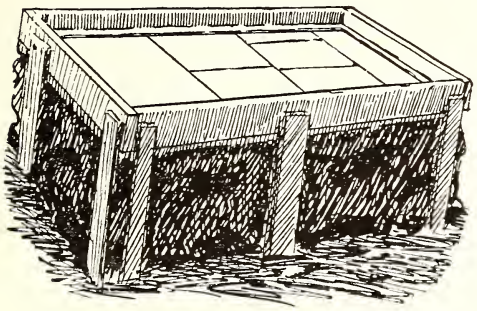
FIG. 1.—DRAWING LINE ON ROUND TOP MARKER.

blacksmith's assistance) or with a thick piece of tin. Care should be used, for it must be exactly true, a 45 mitre. One made of sheet iron or wood will have two parts joined together. Before joining them they should be fitted exactly correct, and then mark the joint. One made of tin can be made from one piece. Do not try to cut the tin with a chisel, for it will get all out of shape, but use the scissors.

HOW TO PREPARE A RUBBING BED.

A rubbing bed should be constructed in a manner that it will be useful and durable and that will insure quick setting up and taking down. There should always

be as many feet of stone placed in a bed as possible for the wheel to reach. One large bed can be finished much faster than two or three small ones. The stone should be set as level and even as possible. A box is made as illustrated here, using good, strong boards the size of the bed. They must be nailed together firmly. Un-



der these nail boards at right angles on all sides. They help to get closer to the surface of the stones and form a place inside that will level up better than if only perpendicular ones were used. These box shaped boards are lifted on top of the granite and fitted as well as possible. While one man holds, another must nail small boards at the ends and sides. They must rest on solid ground or floor. Between each piece of granite there are large and small openings. They are partly filled with small pieces of granite. Large quantities of plaster of Paris are mixed in a bucket, then spread over the whole surface, filling all the holes, using a wide wooden trowel. After the plaster has been smoothed over the bed it must dry before commencing to grind. When you have stones to be put in the bed that have one or more polished surfaces they should be prepared beforehand, so they will not get any of the rust from the grinding on them. Then plaster of Paris on these surfaces, put on with a broom, will prevent the rust from coming in contact with the polish. After the stone has been polished on all the sides necessary the plaster must come off and the stone be cleaned. This is done by using muriatic acid with a stiff scrubbing brush, which will remove the plaster. Then it is thoroughly washed with clear water and taken to the letter cutter's bench.

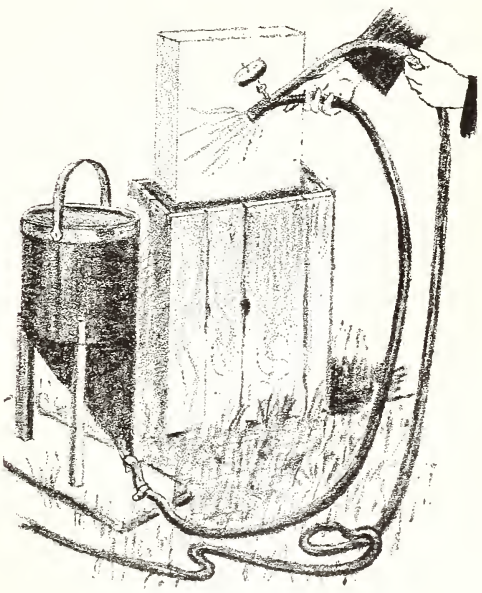
RUST ON BOTTOM BASES.

Seeing an inquiry as to the cause of the rust lines that frequently appear on "all hammered" bottom bases, I think this rust is frequently caused by running the lawn mower so close to the stone that the hub of the wheel scrapes along the surface, leaving particles of iron which become damp, and this causes them to rust, leaving the streaks around the base. This can be readily proven by noticing any job that has a marker set so close that the mower can not be run between it and the base. The rust lines stop and do not show except where the mower can be run; also they do not show at all on rock face bases.

SAND BLAST MARBLE CLEANING.

Thomas Gamble, of the Blue Ridge Marble Company, that furnished the marble for the new postoffice at New Orleans, cleaned the marble by an interesting modification of the sand blast system. The Blue Ridge Company contracted with Gibson & Schiller, of Chicago, to do this work of cleaning. The Chicago firm began work with the regular apparatus for sand-blast cleaning, but Mr. Gamble has offered some original ideas of his own that it is interesting to note have modified and improved the older process.

The original sand blast has been used for cleaning various kinds of building stone and for removing dirt and rust from metals for years. The apparatus consisted of two tubes ending in a single nozzle. Through one of these air was forced under pressure from a compressed air reservoir, and through the other sand was



SAND BLAST MARBLE CLEANING.

forced by means of air pressure from a closed reservoir.

Mr. Gamble has obtained this same blast by a much simpler process. Instead of having the sand forced through the sand tube from a bulky reservoir, in which air pressure has to be maintained, he allows the suction of the air current to draw the sand into the sand tube from a little pile of sand at the intake end of this tube. The little sand pile is fed from the lower opening of an open reservoir that holds about a bucket of sand, and can easily be carried about on the scaffoldings by the operator. The sand can be replenished without interrupting the cleaning process, which in itself is a distinct advantage.

The sand blast that Mr. Gamble uses is similar in action to an ejector. The blast used generally is composed of a tank of about forty gallons' capacity with an air pipe leading into it from one side and a hand plate which can be loosened to allow filling with sand. After filling, this plate is tightened to prevent the air pressure blowing the sand out. At the bottom of the tank there is an outlet with a valve to which a hose is attached with a nozzle, which is carried to the point where the blasting or cleaning is to be done. The air pressure is then turned into the tank and forces the sand through the hose and nozzle against the stone or other material to be cleaned. The working is satisfactory, except for two reasons: The sand, being forced through the hose, cuts both hose and nozzle out very quickly; second, the operator has to stop work when all the sand is used out of the tank, shut the air pressure off, take out the plate and refill. With the outfit of Mr. Gamble's the tank is open, with simply a screen over the top, and will work continuously by pouring in more sand from time to time. As the sand is not under pressure until it reaches the nozzle, the wear on the hose is very trifling. The wear is practically all in the nozzle, which is made of tool steel, tempered hard. The accompanying picture shows the blast cleaning a piece of white marble that has been painted black with antihydrine. Four of these blasts were used in cleaning the post office and they were so light the operators carried them about on the scaffolds with them.

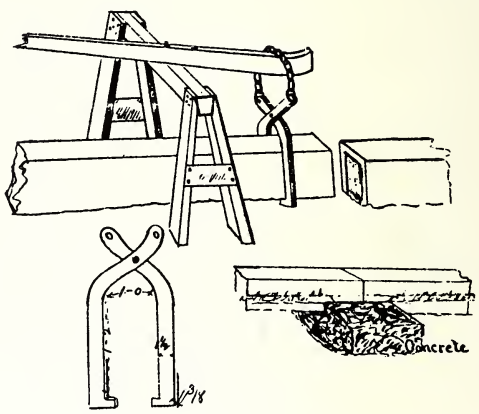
SEALING WAX FOR MENDING BROKEN PARTS.

It may not be generally known that stationery sealing wax is a good adhesive to mend broken parts in either granite, marble or soft stone. The wax can be bought at any stationery store at five cents a stick, in any color desired.

To mend a broken part that has not been finished, chip off wax on broken part, then place broken piece on it; heat iron about one inch in diameter to cherry red; hold it on broken piece until wax is thoroughly melted, then go ahead and finish work. To mend stone that is finished place asbestos between hot iron and broken part or heat white sand to heat broken parts.

SETTING CURBING.

For a quick and easy way to set curb, use the arrangement shown in the accompanying sketch, setting the curb on ground or in ditch as necessary, tamping all along



stone with dirt. When job is complete, excavate under each joint as deep as may be necessary and fill space with good concrete, letting same come up on the side of the stone a little. This will keep the joints from sinking, or springing sidewise, and is quicker than building piers and saves sizing to even depth at joint to fit piers.

JOHN HARWOOD.

SETTING CRADLE JOB WITHOUT BOTTOM SLAB.

Here is a good way to set a cradle job where no bottom slab is used. Make a frame, using 6-in. lumber, large enough to go all around job with 2-in. space between lumber and marble work; make another frame to go inside of cradle with 2-in. space between lumber and marble

work; tack two strips across the bottom of frames to hold in position, sink in ground as low as wanted, fill in with 4½ inches of good concrete, set marble work, then fill remaining space with good cement mortar; use no pins. Work set this way cannot come apart.

JOHN HARWOOD.

TO SOFTEN GRANITE FOR LETTERING.

To soften granite when lettering apply good turpentine with a brush, one or two letters ahead of your cutting; a workman can cut very much more rapidly and also do more clean-cut work by this process.

SPARKER FOR GASOLINE ENGINES.

In the use of gasoline engines, when the sparker wears out, I find it saves a good bit of time and money and gives just as good satisfaction to substitute a paint of nickel or silver (which you can easily make yourself at a cost of about 5 cents) instead of expensive platinum.

MEANING OF THE SPHYNX.

The unusually important discoveries which were made through the excavations of the Frenchman Legrain in Karnak, have induced the renowned Egyptologist, Prisse d'Avennes, to publish in the weekly journal, Kosmos, an interesting discussion concerning the meaning of the Egyptian Sphynx. While the Greek Sphynx shows a female form with an animal body, the Egyptian art distinguishes besides a female Sphynx a male one and a "Ram" Sphynx with a ram's head. Even the avenues which led to the Egyptian temples were often ornamented with a row of Sphynx. The origin of the Sphynx, which at all events is to be found in Egypt, is not yet thoroughly settled. Out of the dynasties of the old empire only a trace of it remained, namely, an inscription to be found now in the Museum of Cairo, which does not state its exact age. This inscription states that the Pharaoh Chufu had reconstructed a temple which was situated on the place where the Sphynx was located. According to the latest discoveries the Sphynx not only served as a symbol of all Egyptian gods, but also of the Pharaohs and the Queens. The Sphynx appeared first in different forms in the year 1822 B. C. At that time it was in constant use. The Sphynx was also considered as a holy animal of the old Egyptians. In general, it had the body of a lion and the head of a woman with the well-known head-covering which we term the Sphynx headgear, and sometimes with wings. Later on it was pictured on a great many Greek and Roman medallions, and on the seal of Emperor Augustus. In general the Sphynx was the symbol of secrecy. By uniting a human head with the body of a lion a union of mental and bodily strength, and ruling power was denoted. In general we see four symbols represented: Knowledge by the head and the womanly breast; will by the bull body; daring by the paws and claws of the lion, and silence by the wings. The large Sphynx near the pyramid of Chaeops is a native block of stone, 20 meters in height and 39 meters long, which in rough art was given the form of a legendary animal. Only the head, which measures from chin to the top of the head, 8 meters, is carefully executed. Upon the head, which is reached with ladders, there is room for a great number of people, as the flat surface measures about 26 square meters.

Between the forelegs and the neck there is a door which leads through immense underground stonewalks to the great pyramids. Upon the approaches to the temple Ram Sphynx were generally erected, as guards of these holy temples. In the Hall of Columns in the temple, built in honor of Minerva by Pharaoh Amasis at Sais, stood male Sphynx of tremendous sizes. These are formed in Egyptian art with a man's head with or without beard and the body of a lion. But generally the head of this Sphynx represented a portrait of the monarch who had it executed. In the year of 1825 a male Sphynx of wonderful red granite was discovered, whose head resembled that of Pharaoh Amenophis III. Between the fore feet generally a small picture of Pharaoh was placed. The Ram Sphynx which flanked both sides of the great temple avenue at Karnak were about five meters long and their heads alone frequently reached to a height of five meters.

GETTING STEEL FROM THE EYE.

A common accident in a workshop is to get steel in the eye. The thing to do is to prevent it if possible and every workman should wear glasses when grinding tools, for in most cases the emery or grindstone is the cause of the accident. This is done by the fire from the tool

which goes into the eye and burns it, leaving a little speck of dark substance. But should one get a piece of steel or fire into his eye he should immediately go to another workman and have him take it out. This is not done by using the corner of a handkerchief or using flaxseed as for ordinary particles of dirt. The steel or fire sticks in the covering of the eye and must be lifted out by force. To do this use a strong piece of broom straw, cut with a mitre. First place the round end on top of the lid, then press down, turning the lid over it. Then with the bevel edge scrape the place and pull the spot off with a scraping motion. Ofttimes one has to get under the side and pry it out. One must get the best of light on the eye so he can see plainly to do this operation.

PREVENTING "SWEATING" OF STONE.

All workmen are more or less acquainted with the inconvenience of attempting to check in lettering and tracing work when the stone is inclined to "sweat." This trouble is a very common experience in damp and cold weather.

It is a very easy matter to do away with the trouble by simply putting a small amount of sand in a bucket or pan and heating over the stove or forge until it has absorbed all the heat possible. In the meantime a newspaper should be placed over the stone and by pouring the heated sand over this for a few minutes it will be found that the dampness has been done away with and the checking in can be continued without further annoyance.

DISCOVERY OF STONE SAWING WITH SHOT.

The following interesting story of the discovery of the use of shot for stone sawing is from "Harrison's Magazine," the house publication of the Harrison Supply Co.:

Thirty-four years ago John Harrison had a contract for the erection of some government buildings in St. John, New Brunswick, on which there was a short and exact time limit, and it was necessary to resort to every means in getting out and assembling the material. Stone at that time was sawed by means of steel blades set in a swinging frame, sea or river sand placed on the stone and washed by water to the points of contact of the steel blades and the stone. This saw frame was weighted down as it swung back and forth for a more forceful contact with the stone at the points of separation—it being understood that there were as many steel blades, or separate saws, set in this swinging frame as the number of pieces required from a large block as it came from the quarry. Hard stone was sawed in this way at the rate of three-quarters of an inch an hour, and it required the handling, by hand, of 100 tons of sand, which formed the abrasive, during this time. This was the way the stone was sawed all over the world up until thirty-four years ago.

Now, when John Harrison got this short time limit contract in St. John, New Brunswick, he ran his fingers through his hair in an effort to find some way of sawing stone faster, and this idea flew out.

Why not use iron filings instead of sand on the stone saws? He applied the idea and was able to saw 14 inches of stone an hour and only required the handling of one ton of iron filings.

He required more iron filings than he could conveniently buy, so he set up a cupola furnace, melted old stove castings, ran the molten mass out of the furnace in a continuous stream onto a steam jet which blew the mass into the air like fireworks so that they fell into a water tank in globular or shot-like form.

Stone workers from everywhere soon heard of John Harrison's discovery and undertook to beg, borrow, buy or steal some of his new abrasive material, and he soon discovered that there was more of a demand for Harrison's iron shot, as it was then called, than for his services as a contractor, so he moved to Middleborough, England, near the iron mines of that part, in order to be convenient to the raw material, built a plant and began producing his shot on a large scale. John Harrison has since passed on, but a large industry has been built around the production and sale of the material based on his ideas by his sons, Harrison Brothers, of Middleborough, England, and the Harrison Supply Company, of Boston, who have since perfected iron shot to hard steel shot. Its use has been extended into other industries with equal economy, removing sand from castings among other things.

TEMPERING GRANITE TOOLS.

Tempering granite steel can be accomplished by a very simple method While

tempering, keep the following rules in mind, especially rule (2): Rule (1) Heat steel dark red about one-half inch higher than its thickness. (2) Hold it in a water bath up to the line where red heat blends into black. (3) Note the water boiling up and around the steel. (4) As soon as the water quits boiling up and around the steel, (5) withdraw it quickly, (6) lay it aside to temper.

It is not difficult to hold a dark straw color without dipping steel into the bath the second time and can be done by concentrating one rule (2), (4) and (5).

To avoid warping thin bush blades, harden them in oil or paraffine; then draw to a dark straw color over the fire.

These rules cannot be used to temper soft stone or marble tools.

REMOVING TOOL MARKS FROM GRANITE.

"Can you kindly give me some idea as to how to remove tool marks from rock-faced granite? I have tried many ways, but without success.—T. A. C., Cal.

"In using blow-lamp to burn off tool marks or drill holes in granite, first get the lamp burning to a blue flame, so that it will not smoke the stone. Then hold it within two inches of the place to be burned off until the stone begins to peel, helping it by tapping the face of the stone with a chisel as it loosens, always keeping a considerable distance from the edges of the stone or any weak part which would readily break off with the heat."

WILLIAM DUNBAR.

REMOVING TOOL MARKS WITH ACETYLENE TORCH.

* * *

There are usually two kinds of tool marks on rough stone; one kind is made from the point and another from drill. Point marks are easily removed by taking a sharp chisel and scraping the surface hard; then touch it up a little with a lead pencil; this will blur the point marks. If they are drill holes, about the only way to get rid of them is to box it up and ship it back to the man who made it, as it is very difficult to do anything with drill holes. CROSS BROTHERS CO.

* * *

It altogether depends on where they are located, and whether they are on the head grain, or the rift of the stone. If on the rift and not near any edges, we use a blow torch and burn them out. If they are on the head grain, let them alone if you have not stone enough to break them out. The blow torch is dangerous if you have had no experience in using it properly. YOUNG BROTHERS CO.

* * *

The only way we do it is by using a plumbers' torch. The heat will expand on the stone and it will come off in thin pieces. We cannot go near the edges or near letters. It has to be used very carefully, and after it is done the stone should be kept wet with papers to bring the color back. J. P. CORSKIE & SON.

* * *

To take tool marks out of rock-faced granite, the first thing to do is to get a good blow torch and see that you get a good, hot flame from it. Hold this flame against the place where the tool marks are. This will crack the granite and loosen it up in small scales. With the left hand hold a sharp chisel about one-half inch wide. Pry the blade under the scales and force them off. This must be very carefully done to insure a good surface. One must be very careful when heating the stone near a corner or an edge for fear they will come off in a large chunk. Do not hold the flame against any place too long for fear of cracking

the stone from one side to the other. By being careful and only heating the stone in a small place, then prying off the scales several times, this process does the work.

J. W. WYCKOFF.

* * *

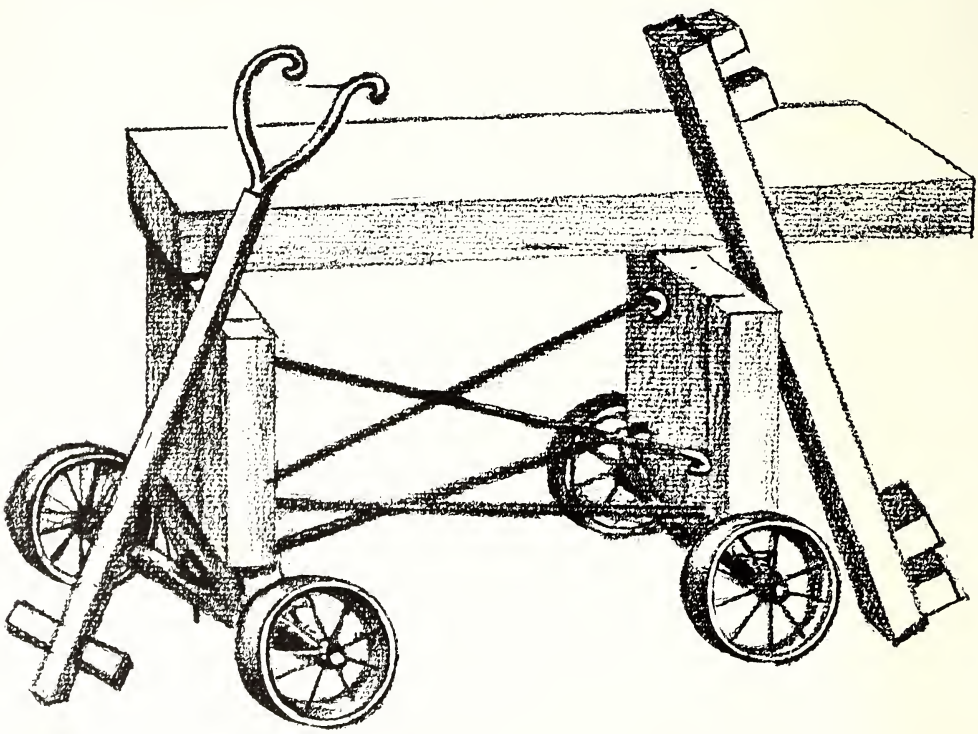
Joseph F. Gast, the Chicago monument dealer, has developed an interesting use of the prestolite torch and tank for granite work. Mr. Gast has for about six months carried on experiments with the Prest-O-Torch as an aid to the removal of tool marks, stains and other blemishes from stone. The experiments have been entirely successful. Hitherto this company, the Gast Monumental Works, has used a gasoline blow-torch for this work, but, according to Mr. Gast, Prest-O-Lite is much better than the other method. "After experimenting with the Prest-O-Lite outfit," he said, "I found that by using the different sized torches, and with the scheme for regulating the pressure, one can do wonderful work. By heating the granite where the blemishes or defects are, these parts will lift right off and leave a nice, clean, uniform surface. Anyone who has been accustomed to using the gasoline torch outfit could use this without any difficulty whatever and do cleaner and faster work."

In removing marks of any kind from stone, the stone is heated as in the illustration. The heat causes the surface of the stone to disintegrate to such an extent that with a suitable chisel a thin wafer of stone can be pried off. The stone is left with a clean, smooth surface. This torch and outfit is furnished by the Prest-O-Lite Company, of Indianpolis, Ind.

COMBINATION TRUCK AND BANKER.

The illustration shows a combination truck and banker constructed by T. M. Heagy. It can be taken apart and placed on a wagon and taken to the cemetery and was made at a cost of about ten dollars. Any country blacksmith can make it; it will carry a ton.

The top is 22 inches wide by 3 feet long, and is made of 2 inch white oak lumber; in fact, all the lumber is 2 inch white oak. It stands 22 inches high; the top boards can be lifted off. The running gear is on the same principle of a two-horse wagon, with the exception of the coupling, which is made of one-inch round iron. The bottom coupling is made Y-shape; the two arms shown are connected with the back axle; the ends of this coupling are L-shape and are dropped down into the eyes that extend through the front

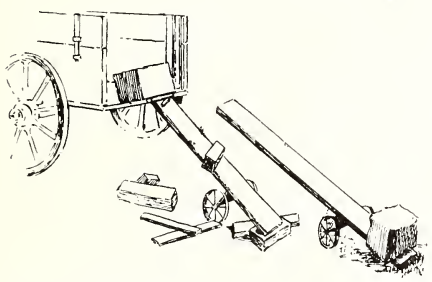


COMBINATION TRUCK AND BANKER.

and back axles. The other two stay irons run from top to bottom and from bottom to top these irons are L-shape and also drop down into these little round eyes, and all of them can be lifted out very easily. The tong is in a Y-shape and is fastened with hooks. It can be lifted off or put on easily. You can back it up to a wagon, roll the stone on, take it right into the workshop, unhook the tongue, and use it as a banker. It will carry a ton and will not weigh over 250 or 300 pounds.

A HANDY LOADING TRUCK.

The handy loading truck illustrated is good for trucking stones around the show room and yard and the shop. By letting either end down to the ground a stone can be turned over on the end and re-tuned until it is on a balance on the truck, which generally is over the wheels. The stone can then be wheeled to a banker, the end of the truck placed upon the end of the banker, and the stone rolled over and over until it is in a proper place for cutting. A stone can be loaded into the hind end of a wagon by placing the long end of the truck on the bottom of the wagon bed, then turned over and over or rolling it until it is placed in the wagon. This long board should be two inches thick and made of hard wood. The wheels are cul-



tivator wheels taken from the field, or similar ones. A good axle and brace are all that is required to complete the vehicle.

W. J.

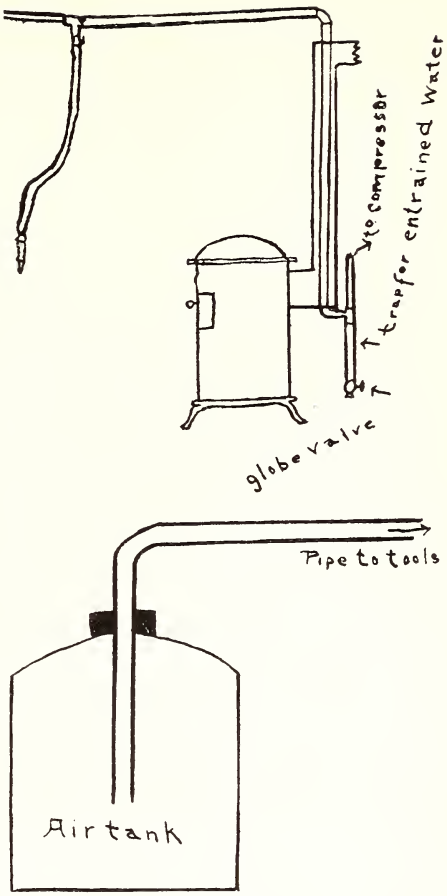
WATER AND OIL IN AIR TOOLS.

We have overcome the trouble with water and oil coming through pneumatic tools by employing an auxiliary tank between the compressor tank and the tool. The air is piped to and from the top of this tank and at the bottom we have a drain with drip-cock.

QUINCY AVENUE GRANITE CO.

* * *

To prevent oil and water coming up into



air tools one should first keep his air tank warmer and by so doing keep the moisture and oil vapor from condensing and then working up the sides of the tank and into the pipe to the tool. If this should fail to remedy the trouble, put a piece of pipe down into the tank, as shown in the accompanying drawing. Extend the outlet pipe down into the tank six or eight inches and when the water works up the sides of the tank and out across the top it will run down the pipe inside the tank and drip off and should then be drained off.

J. V. GAEBLER.

WARMING AIR FOR PNEUMATIC TOOLS.

Regarding the use of a coil of pipe to put into stove to heat the air for pneumatic machines, I would like to know if there is anyone using such a device, and I would be pleased to learn just about how many feet should be in the coil of pipe to insure warm air for a 1-inch tool or a ¾ tool for carving and lettering. What would be the best kind of pipe and what size pipe? Would not the heat of the

stove evaporate the cold air and turn it into water? Are these coils on the market? J. T. W., Pa.

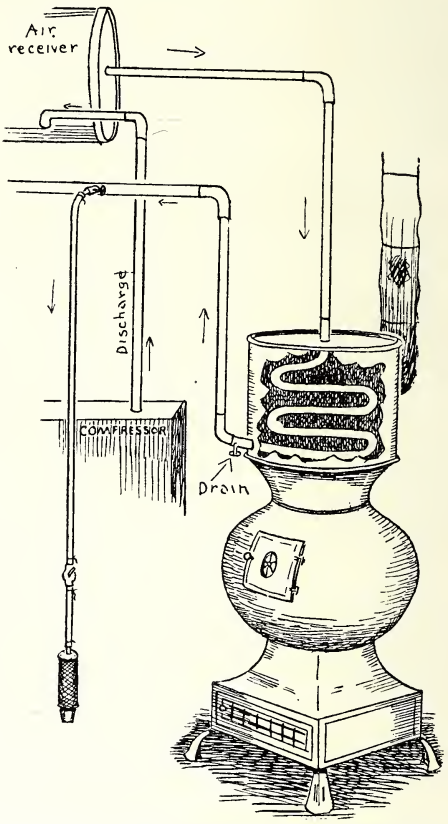
* * *

The illustration here shows how the pipe is used in a stove to heat compressed air. The pipe comes from the air receiver into the top of the stove and out at the side, going to the pneumatic tool. This is a practical workshop stove and the pipe is at the top. By running the pipe in at the top the air is gradually heated. One-inch pipe is sufficient for one or two machines and about five or six feet is necessary. Gas pipe is the proper pipe to use. Heat will not evaporate the cold air and turn it into water; it will make the air perfectly dry. Air heats as it is compressed and cools as it expands. A coil of pipe should be placed at least ten inches above the fire. Another practical way to use pipe is to coil it around the stove on the outside, and unless a workman is quite a distance from the stove this plan may be the best, because the air would be too hot with the pipe inside. Another way is to run a pipe in at the top of the stove and turn over and repeat back through another hole at the top. This can be arranged so that the pipe can be raised or lowered according to the amount of heat in the stove. Pipe will not last as long on the inside as on the outside. Large manufacturers who have boilers, so that hot water is easily procured, find that the best way to heat air is by using a lead coil in hot water. This is probably the best way to heat air, for the reason that the water can be made warmer very quickly or can be cooled off by the addition of cold water, thereby insuring a regular temperature of air. By putting the lead coil into a barrel of water the exhaust of steam from the boiler keeps the water and air hot. Coils of pipe should have a drain attached, so as to let out all the water every morning before starting a fire in the stove. The greatest heat is obtainable from the coil placed inside a stove, but it is claimed it is not as serviceable as on the outside or by the use of a coil in water.

There are in use quite a number of coils used to heat compressed air, using lead pipe.

The J. H. Anderson Granite Co., of Chicago, uses a coil in the stove, as illustrated. I do not think these coils are on the market for sale, but any competent steam fitter or plumber can rig up this outfit. FOREMAN.

Regarding the merits of several methods of heating compressed air for pneumatic tools. We have tried the various methods suggested and also the following, which we find the cheapest and most satisfactory: Simply run a straight piece of pipe inside the stovepipe, letting it enter



HEATING THE AIR FOR PNUEMATIC TOOLS.

and pass out through elbows. The pipe should be of ample size, so that the air will not have to travel too rapidly. A 1¼-inch pipe, 6 or 8 feet long, will be large enough for six hand tools. Accompanying sketch will make our meaning plainer. There is less danger of heating the air too hot for the rubber hose with this arrangement than with a coil of pipe inside stove.

C. H. GRANT GRANITE CO.

* * *

In shops where they do not have warm compressed air one can keep the tool from being so cold by wrapping a string around it. A good, strong string should be used, preferably the kind called top string. Tie one end around something solid and turn the machine around carefully so that it is wound closely. It is a good idea to put some glue on the string at different places

to make it firm and compact. The string should be tied at the top part of the hand held to prevent the knot from being in the way and bothering the hand. One should wrap the machine in thick cloth every evening before leaving the shop. This keeps it warmer and it will be in better condition to use the next morning.

WEDGE LEAD AND JOINTING MONUMENTS.

"We have been using for a number of years wedge lead for jointing granite monuments, and we find that after the lead is exposed to the weather for some time that it discolors and does not match the stone, and we have known of other dealers who have used a mixture of some kind which has been made to match the stone and which hardens reasonably quick, and we are writing to ask that you advise us, if you can do so, just what this preparation is and how it is used. We have also used imported Puzzolan cement, but we find that in some cases it stains the stone."—T. M. Mbl. Co.

The recipe we use for putty to set monuments is as follows: One part of dry white lead to two parts of clean, finely screened granite dust (Barre). Mix well, dry, then add Copal varnish until a thick putty is formed, mixing with hands same as kneading bread. Roll out into rolls about the thickness of little finger, place around edge of monument and set stone on top, then cut the edges with a sharp knife. If round or bead joint is required, use common tuck pointing tool. This putty can be colored to any shade of granite by using dry coloring.

Geo. Archer & Son

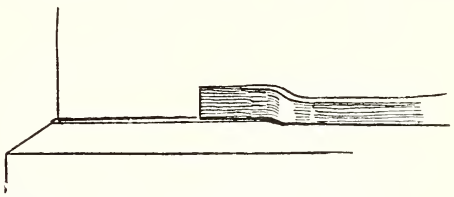
Regarding leading joints, a cheap and permanent substitute for wedge lead can be made of pure white lead and stone dust. Make to consistency of putty and work into the joint the same as you would putty. This can be trimmed off flush with a sharp knife or beaded with a mason's beading tool. This mixture must be made several days before being used and kept in a covered can. Should any oil get into the stone from the white lead, it will quickly evaporate. Where the mixture is made up ahead, it is not liable to stain the stone, as the stone dust takes up the oil. Meyer's German cement can be used in the same manner, but is rather expensive. Good Portland cement and stone dust can also be used in the same manner.

Deming Hardware Co.

The only cement we can recommend is our Meyer's German cement. We believe this is just what the party requires.

Michael Cohen & Co.

We use almost exclusively wedge lead, but we have also used a preparation of white lead and granite dust with a little varnish added to aid the drying. Such a preparation gives good results and can



CHISEL FOR CLEANING JOINTS.

be colored to suit the granite. Method of using the above is to press into the joints and either clean off smooth or use a beading tool.

William Dunbar.

The best mortar that can be used for jointing monuments is our Stonekote monument mortar, No. 1119. This is white and waterproofed; will not stain either stone or granite. This kind of cement should be used for all except the surface pointing. By crushing the spalls of the monument you are setting and screening through a 20 mesh screen, then mixing two pounds of those siftings with one pound of the monument cement, you can darken the material for the pointing of the surface joints.

The Garden City Sand Co.

A good composition to use to joint granite monuments is German cement mixed with granite dust. For light hammered granite about three parts of cement and one part of clean, fine dust. This cement always sets a little darker than when it is wet. A good plan, if you cannot get granite or marble dust lighter than the stone, is to put in a little white lead, which will make the color lighter. If you are jointing a dark stone like dark Quincy granite, mix some lamp black in the solution, which will help get the color required. This mixture can be put on with a small trowel. It is always best to cut four pieces of corking lead and place them at each corner, so that the mixture will set the proper thickness, otherwise it would generally squeeze out. It is hard to clean a joint nicely unless you have a chisel made as illustrated here. The chisel is very handy and one can set the block

perpendicular while sliding it along the joint. J. W.

* * *

Regarding my experience with wedge lead, cement and white lead, when used for filling joints in granite, I have never seen many cases where Puzzolan cement, or any of the stainless cements made in this country, stain the stone around the joints, providing the cement was properly mixed and where clean sand, water and tools were used. I think this very important, especially on mausoleum work and where a beading tool is used for pointing the joints. In some cases where acid is used to clean the stone and where the acid is not thoroughly washed out of the joints, it will cause stains to appear around the joints and make it appear as if the cement caused the stains.

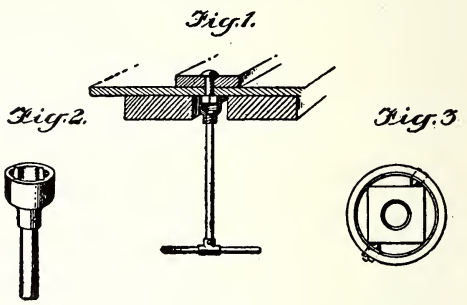
The mixture to which your inquirer referred is composed of two parts of granite dust to one part of dry white lead. These are thoroughly mixed together dry, then enough Copal varnish is added to make a thick paste. The mixture is kneaded until it is like thick dough. It is then rolled out into long round strips between the hands and these strips are then laid around the bed of stone. The next stone is then set or lowered on top of this bed and the paste is trimmed off flush with the face of stone. Pieces of sheet lead should also be placed on each corner of the stone, otherwise the weight of the second stone will press the paste out of the joint too much.

This paste can also be used for filling joints in mausoleums. When used in buildings the cement should be well raked out of joints when stone is set and then, after building is set, the paste is pressed into the joints. A beading tool can be used or the paste trimmed flush with joints. H. F. GARDNER.

WIRE FOR PNEUMATIC HOSE.

The wire recommended for use for the hose leading to your pneumatic tool is bailing wire. It can generally be found at any stable where they use hay. If you have a hose plier, cut a piece the length required, and with the plier bend the two ends in opposite directions and place the wire around the hose. Cross the ends. They will come nearly right for the two plier holes. Insert one end in plier hole, pull the plier over and catch the other end, then squeeze the handle ends together tightly; also twist the wire at the same time, unloose the plier from the wire and pound the ends of the wire down flat against the hose. It is generally advisable to put two wires on the hose. It will insure a tighter hold. If you have not a hose plier use an ordinary pair of pliers. The wire will have to be cut longer. Clasp both ends with this and twist several times until the wire is tight. Pound down the wire as when using hose pliers.

WRENCH MADE FROM PIPE FITTINGS.



The accompanying illustration shows a convenient wrench made from pipe fitting for the purpose of tightening nuts that are inaccessible to an ordinary wrench. The wrench is made by filing four grooves with a common reducer, as shown in Fig. 2, to fit the corner of the nut. Instead of filing grooves in the reducer, studs may be screwed through the sides as shown in Fig. 3. Reducers of different size should be used to fit different nuts. A hole may be drilled through the connections and a pin inserted to prevent them from unscrewing while the wrench is used for tightening or loosening a nut.

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A buyers' guide to announcements of firms offering supplies and equipment for the monument craft.

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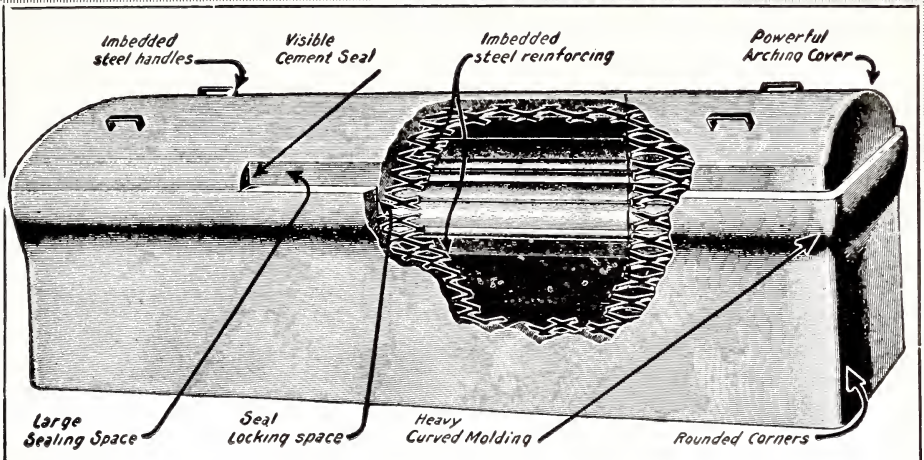

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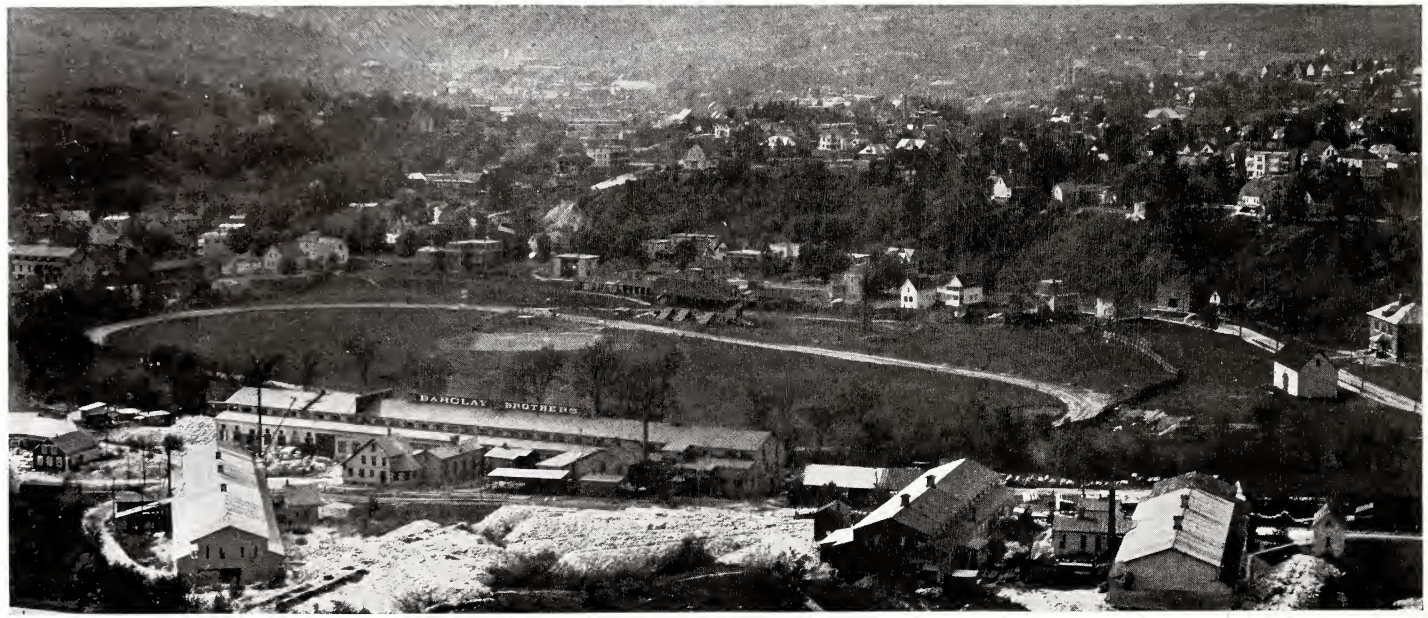

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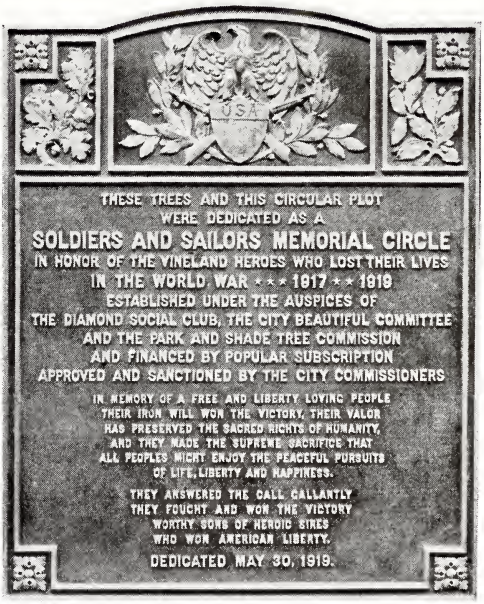
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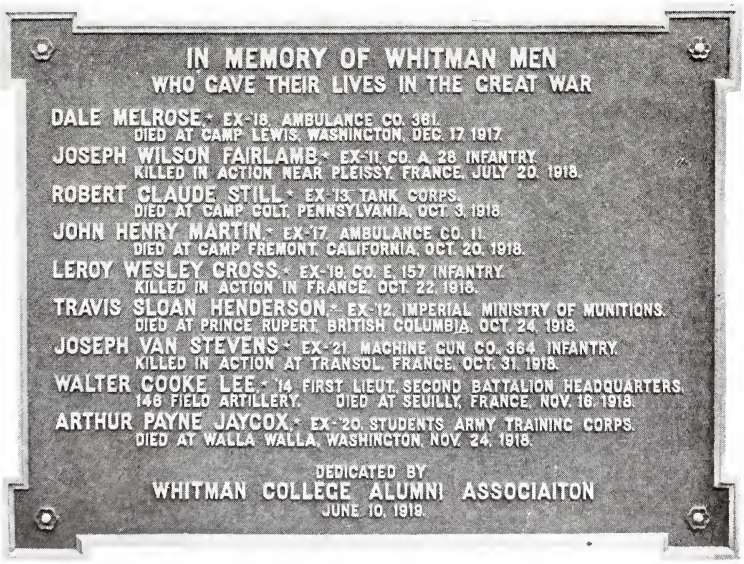
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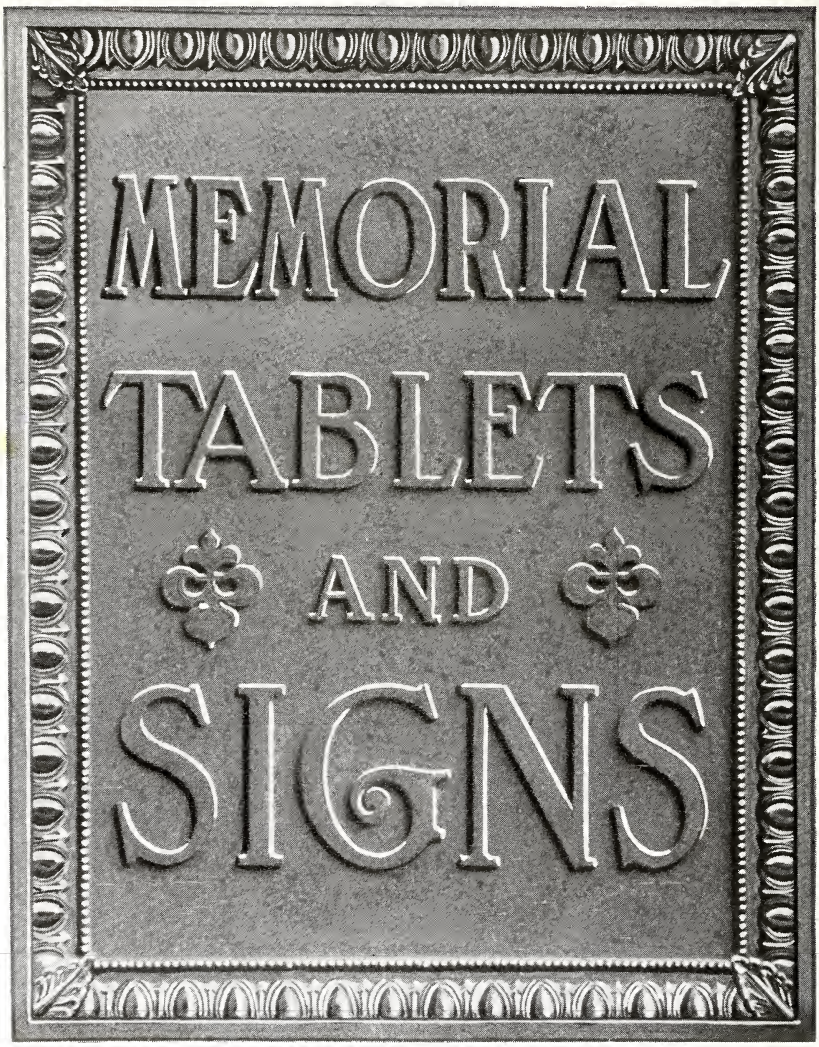

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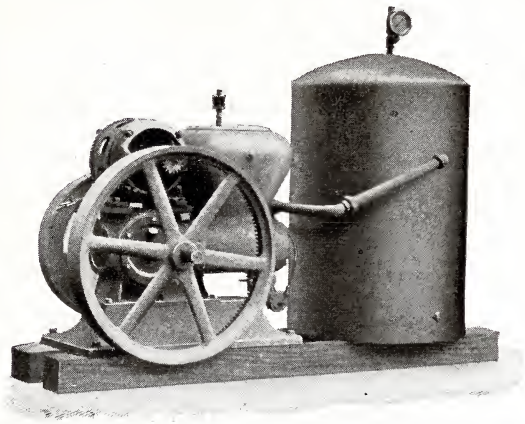

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Sold to ..... " .....
Erected at ..... " **Erected** .....

Cost at Quarry .....
Freight from Quarry.....
Hauling, Depot to Shop.....
Freight to Destination .....
Hauling to Cemetery .....
Lower Base .....
Markers .....
Corner Posts .....
Base Name .....
Inscriptions .....
Monogram .....
Tracing .....
Foundations .....
Setting .....
Boxing .....
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Agent's Commission .....
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Total Cost .....

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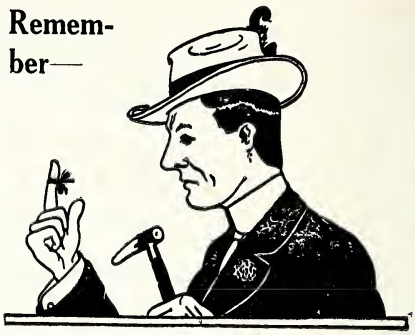

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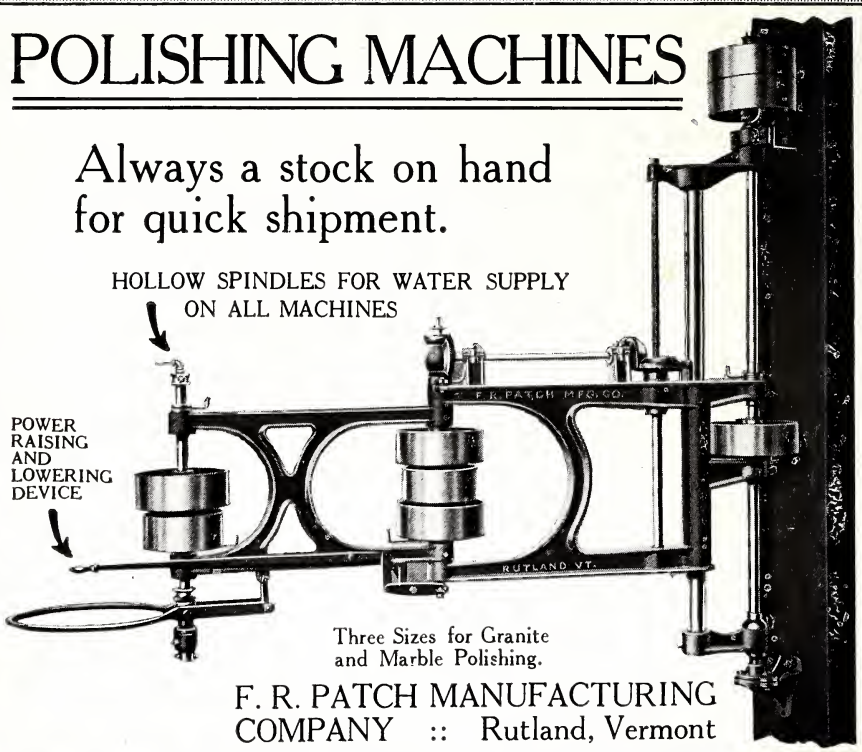

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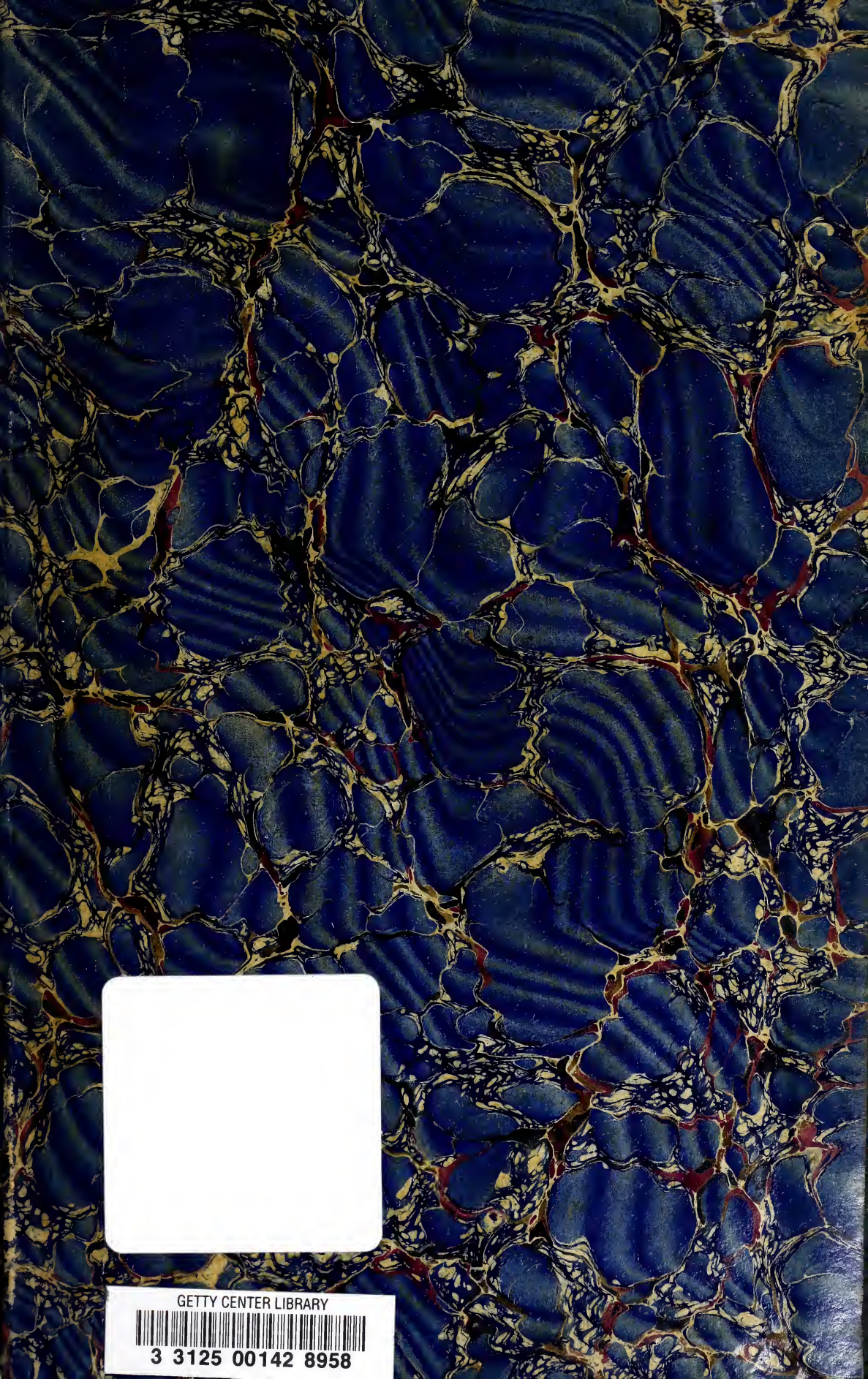
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